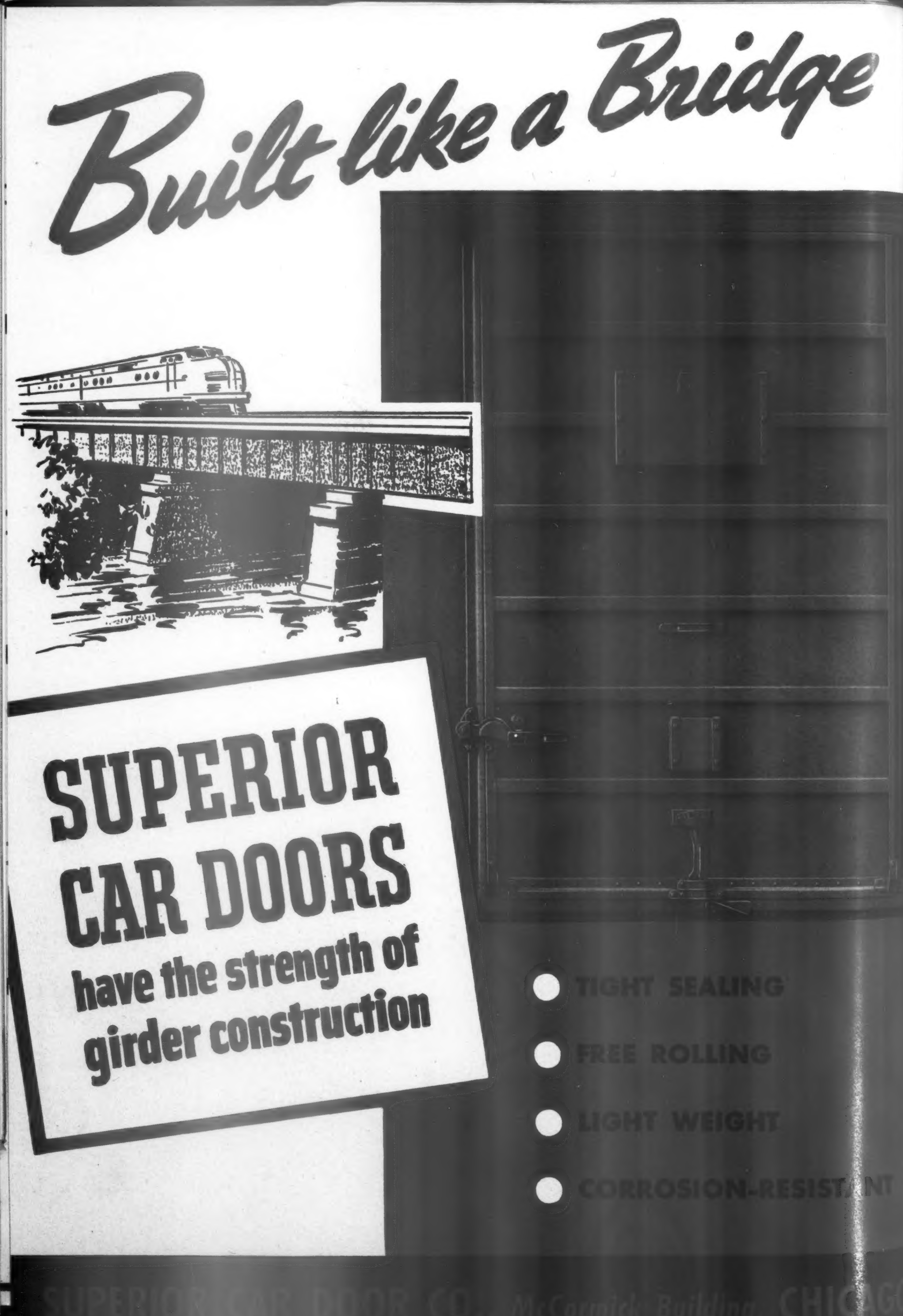
Railway Mechanical Engineer

September 1941

FOUNDED IN 1832


Built like a Bridge
SUPERIOR
CAR DOORS
have the strength of
girder construction
TIGHT SEALING
FREE ROLLING
LIGHT WEIGHT
CORROSION-RESISTANT
SUPERIOR CAR DOOR CO., McCormick Building, CHICAGO

RAILWAY MECHANICAL ENGINEER

Founded in 1832 as the American Rail-Road Journal

With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office.

Volume 115 *No. 9*

SEPTEMBER, 1941

Published on the second day of each month by

Simmons-Boardman Publishing Corporation

1309 Noble street, Philadelphia, Pa. Editorial and Executive Offices: 30 Church street, New York, and 105 West Adams street, Chicago. Branch offices: Terminal Tower, Cleveland; 1081 National Press bldg., Washington, D. C.; 1038 Henry bldg., Seattle, Wash.; 550 Montgomery street, Room 805-806, San Francisco, Calif.; 530 W. Sixth street, Los Angeles, Calif.

Subscriptions (including, when published, the daily editions of the Railway Age, published in connection with the convention of the Association of American Railroads, Mechanical Division), payable in advance and postage free, United States, U. S. possessions and Canada: 1 year, $3; 2 years, $5. Foreign countries, not including daily editions of the Railway Age: 1 year, $4; 2 years, $7. Single copies, 35 cents. Address H. E. McCandless, circulation manager, 30 Church street, New York.

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.), and is indexed by the Industrial Arts Index and also by the Engineering Index Service. PRINTED IN U. S. A.

... and that's not all —

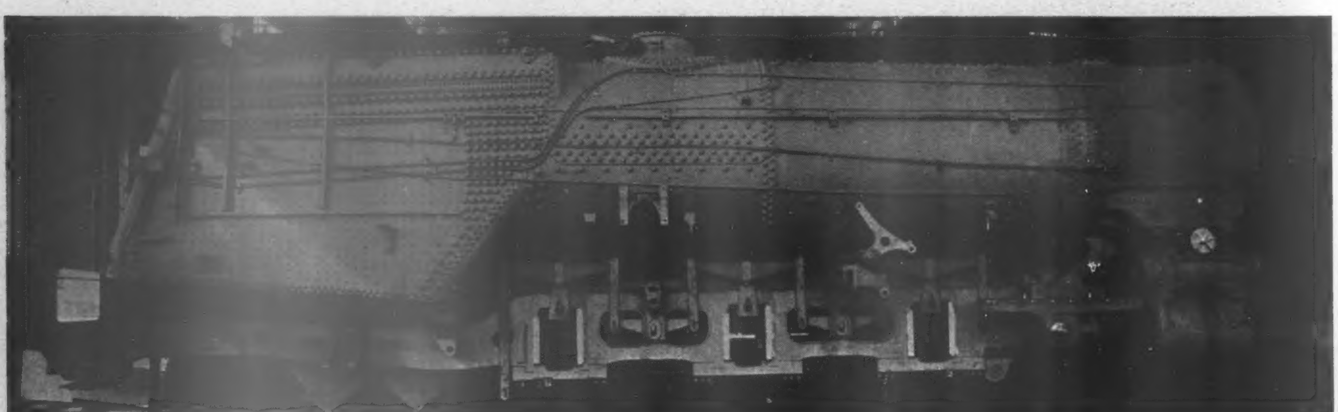
BYERS STAYBOLT IRON

saves us almost $45 a ton!

MEETS TOLERANCES. No need to "soften up" on size and out-of-round requirements. Byers Staybolt Iron meets ASTM-A-84 and AAR-M-305 specifications in all respects.

CLEAN SHARP THREADS. Threads have full bearing, and develop full strength. Tensile strength, fatigue resistance and other physicals are remarkably uniform.

COSTS LESS. Savings have run as high as $45 a ton. Large capacity and specialized equipment permit Byers to produce the highest quality iron at a quantity price.



DEPENDABLE SUPPLY. This locomotive is under construction in the shops of one large user of Byers Staybolt Iron. A number of leading railroads have tested, approved and are using it. Byers has the capacity to produce any needed tonnage of staybolt iron, without any compromise of the stringent standards that this important part demands.

FORGING BILLETS. For matching quality, order Byers Genuine Wrought Iron Forging Billets. Square, round or rectangular sections, to ASTM-A-73 or AAR-M-305 specifications.

A. M. Byers Company does not manufacture or sell staybolts, but merely supplies the iron to bolt manufacturers and to railroads. The use of Byers Staybolt Iron has effected savings for many users. If you are interested in an assured source of supply, highest quality and uniformity, and a probable substantial saving in costs, just ask for details.

A. M. Byers Company, Pittsburgh, Pa. Established 1864.
Boston, New York, Philadelphia, Washington, Chicago,
St. Louis, Houston, Seattle, San Francisco.

BYERS
GENUINE WROUGHT IRON

RAILWAY
MECHANICAL ENGINEER

More Aluminum-Alloy

Streamliners to West Coast

Two additional 14-car trains—the "City of San Francisco" and the "City of Los Angeles"—added to C. & N. W.—U. P.—S. P. and C. & N. W.—U. P. fleets

Two 14-car aluminum-alloy streamliners have recently been placed in service on 39¾-hr. schedules between Chicago and the Pacific Coast. The City of San Francisco, which went into service on July 26, replaces the Forty Niner, which formerly operated on a 54-hr. schedule, between Chicago and San Francisco via the Chicago & North Western, the Union Pacific, and the Southern Pacific. The City of Los Angeles began its service life on August 3 over the Chicago & North Western and the Union Pacific, replacing the former City of Los Angeles train, the "Copper King," which has been assigned to service between Chicago and Portland, Ore. The motive power for each train is a 6,000-hp., three-unit Diesel-electric locomotive built by the Electro-Motive Corporation. The 28 cars in these two trains are drawn from a lot of 14 railroad-owned passenger cars and 23 Pullmans recently built by the Pullman-Standard Car Manufacturing Company for general service in the two pairs of "City" trains which are now in service.

The normal consist of the new City of San Francisco is one baggage-dormitory car; one 48-seat chair car; one diner-kitchen car seating 32, articulated with another diner seating 64; a club-lounge car seating 35, and nine Pullman sleepers, one of which includes an observation-lounge seating 31 persons. The 14 cars in the City of Los Angeles include a baggage-dormitory car; two chair cars, seating 48 each; one cafe-lounge, seating 52; one diner, seating 56; eight Pullman sleeping cars, and one club-lounge, the "Hollywood," seating 30. None of the cars in this train is articulated. The weights of the various types of cars in these trains are shown in the table.

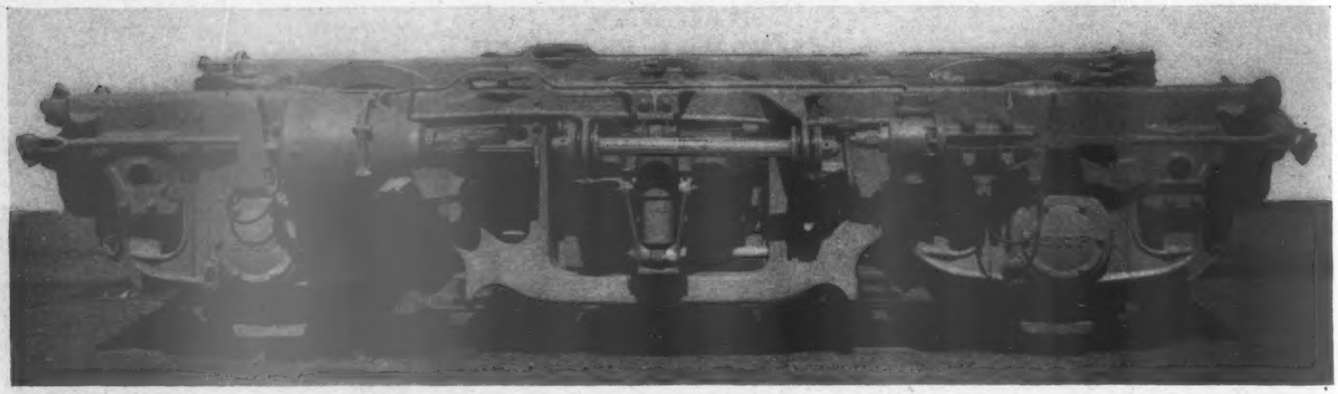
Construction Compared with Previous Trains

A comparison of the new aluminum-alloy cars with those previously built shows that the new cars are built to meet fully all requirements as set forth in the A. A. R. specifications for the construction of new passenger equipment cars, dated March 24, 1939.

All underneath equipment in the new cars is enclosed in Monel metal shrouds or bottom enclosures. The shrouds are designed with removable doors for access in servicing equipment. Such shrouding was not provided on the previous cars.

Louvered skirts projecting below the side sills have been applied between the trucks. These act with the shrouding to deflect downward the air currents under

The 6,000-hp. Diesel-electric locomotive for the "City of Los Angeles"



One of the four-wheel trucks

the cars. The previous cars had skirts, but they are not louvered. The louvered skirts are made up in short sections, 7 ft. to 8 ft. long, hinged in place so as to be readily removable when it is necessary to open the service doors of the shrouding.

The rivets on the car exteriors are countersunk and flush with the sides; button-head rivets were used on previous cars. Full-car-length anodized aluminum snap-on mouldings are applied directly above the windows and at the belt rail immediately below the windows. Cars previously built do not have such mouldings.

The exterior paint colors are yellow from eave to side sill, harbor-mist gray on the roof above the eaves and on the skirting below the side sill, with bright red striping. Previous cars are in yellow and brown, with red striping.

The end-sill and draft-gear-sill construction is now a built-up welded design, obviating the need for castings, as in previous cars. Underframe sills and cross-bearers have been redesigned and so applied as to facilitate the installation of all the underneath equipment within the shroud.

All cars are self-contained as to air-conditioning and lighting, with intercommunicating telephone systems and electric heat in addition to the conventional steam heat. The Vapor Zone thermostatically controlled steam-heating equipment is installed in the coach compartments, dining room and lounge rooms. This feature was developed since the previous cars were built.

The air-brake equipment is the H. S. C. high-speed electro-pneumatic type, with a speed-governor control and appurtenances on each car. Previous equipment is H. S. C. type employing Decelakron retardation control in the locomotive cab.

Each car has its own electrical power plant consisting of a 7½-kw. Waukesha engine-driven generator unit burning propane gas, and an Exide storage battery.

Weights of Typical Individual Cars in the New City of Los Angeles Train

Type of car	Plan number	Weight of trucks, lb.	Car body weight, lb.	Total car weight, lb.
Bagg. dorm.	7443	42,100	77,600	110,700
Chair	7444	42,570	80,930	123,500
Chair	7445	42,600	80,400	123,000
Cafe-lounge	7446	42,200	90,300	132,500
Diner	7447	42,250	91,250	133,500
Club car	7451-A	42,100	87,500	129,600
Artic. diner*	7448-9	75,750	153,910	229,660†

* City of San Francisco.

† Includes two articulated car bodies, two four-wheel trucks, and one six-wheel truck weighing 32,350 lb.

The tight-lock coupler, and electric, steam, and air connections between cars

Cars of the former trains are supplied with electric power from a Diesel-electric power plant in the auxiliary baggage-dormitory car.

The main wires and cables are located in a water-tight trough on top of the car roofs, instead of being applied between the sub floor and the floor, as on the previous cars.

The formerly built cars have motor-driven air-conditioning compressors which take electric power from the head-end power plant. On each new car air-conditioning equipment includes a Waukesha propane-gas engine driving a direct-connected 2-kw. generator and a 7½-ton rotary compressor. Low overall height is maintained by the use of the rotary compressor and an engine having the spark plugs and water connection mounted on the sides of the head. The generator supplies power for two fan motors in the condenser unit.

The cooling fan, instead of being mounted on a bracket at the forward end of the engine in the conventional manner, is much lower and only a few inches above the center line of the crankshaft itself. The fan is gear-driven, mounted on ball bearings. To reduce the strain on the blades when the engine is suddenly stopped, the blades themselves are held by spring tension between

two friction plates. The gears which drive the fan are helical and very wide face to make them quiet and durable.

To maintain the low overall height, the reciprocating compressor used on the earlier cars was supplanted with a direct-driven, ten-vane, rotary-type compressor, also mounted on ball bearings at both ends. It has its own self-contained pressure oiling system, and except for one check valve in the return refrigerant line, there are no valves of any kind employed. Inside the compressor case made of drawn steel, the only moving parts are the rotating hub and vanes, which are held against the outer case by centrifugal force—no springs.

This compressor unit differs from the standard unit also in the fact that the condensers are not mounted on the same chassis—also a case of reducing head room—but instead are built into a separate chassis; and electrically driven cooling fans are employed to supply air.

The complete Waukesha air-cooling system includes condensers, evaporators, combination dehydrator filters, heat exchangers, expansion valves, controls and all necessary parts, each set being mounted on rubber vibration dampeners in a unit arranged to be easily withdrawn from underneath the car for inspection and repairs without disturbing fuel, water, Freon refrigerant, or electrical connections.

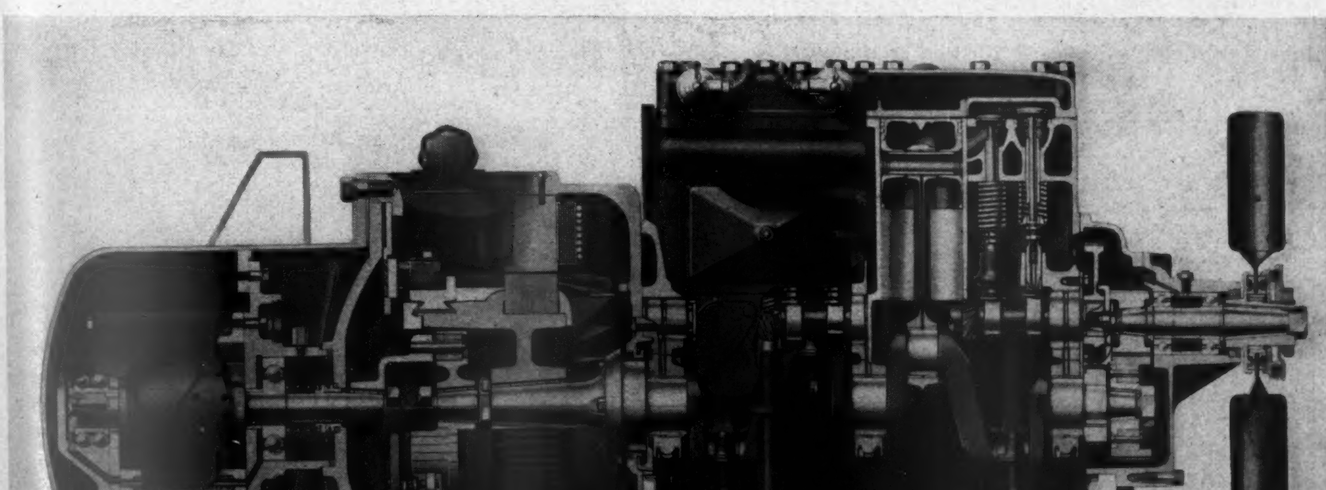
The overhead air ducts are aluminum, coated on the outside with Dednox ⅛ in. thick. The air outlets are aluminum Multi-Vent panels, hinged so that the entire bottom sheets of the duct may be dropped for easy cleaning. Separate filters are installed for fresh and recirculated air, the former also having a secondary filter to clean this air thoroughly before it is mixed with the recirculated air.

The capacity of the air-conditioning equipment is such that the temperature conditions inside the cars can be maintained at 76 deg. F. dry bulb with 63 deg. F. wet bulb when the corresponding outside temperatures are either 120 deg. F. and 70 deg. F. or 110 deg. F. and 80 deg. F. The quantity of fresh air per car is calculated on the basis of 10 cu. ft. per min. per person carried, or not less than 600 cu. ft. per min. for any type of car.

One of the chair cars in the "City of Los Angeles"

Fluorescent lighting in attractive fixtures of special design are installed in club and lounge cars, diners and chair cars. The former have Lumiline and Mazda incandescent lamps.

In addition to the radio reception utilized in the former trains, each chair car in the new trains is equipped with 10 radio pillow-type speakers, embedded in a sponge-rubber pad, which can be placed against the head, allowing only the user to hear. Receptacles are



The Waukesha air-conditioning power unit consists of a propane-gas engine, electric generator, and rotary refrigerant compressor—The generator furnishes power for separately driven condenser fans

The club car "Hollywood"

available at each seat for plugging in when desired. The hardware throughout the trains is of nickel-bronze, natural-finish.

In the two club cars, Precipitron filter units are located in the main air duct. This unit is an electrical device consisting of highly charged plates which electrostatically remove all dust passing through it and also a high percentage of the bacteria. A new type of bacteria-destroying lamp, emitting ultra-violet rays, is installed in the provision chambers of all refrigerators.

For the dining cars the Electro-Pneumatic Company's electro-pneumatic door opener and closer, operating in conjunction with the end-door lock, is installed. With this device a gentle push or pull causes the door to open or close by air pressure.

The equipment of the cars includes National tight-lock couplers and Waughmat rubber draft gears.

The trucks are of the same general type, but have been improved over those applied to the earlier trains, primarily by a more effective spring arrangement and the use of wide pedestal wing-type journal boxes with rubber-cushioned restraining rods and a derailment safety guide incorporated in the design. General Steel Castings truck frames and bolster are used, also stabilizing rods, rubber-cushioned pedestal liners, insulated center plates, bolster locking device, and Drews spring-type side bearings. The 36½-in. rolled-steel wheels have machine-finish treads and machined front and back rim faces.

The trucks on the City of San Francisco cars are fitted with S. K. F. roller bearings; those on the City

(Continued on page 350)

The club car of the "City of San Francisco"

The new "City of Los Angeles"

Research and Design of Modern

Steam Passenger Locomotives*

Part II

By P. W. Kiefer†

Freight and passenger locomotives of the 4-8-2 type—Present trends suggest the feasibility of a 4-8-4 type steam locomotive capable of delivering 6,000 cylinder horsepower

Freedom from lost motion and smooth-running machinery are highly desirable characteristics of this type of driving-wheel-and-axle assembly, and in order definitely to determine (1) the rotational speed at which the driving wheels actually lift from the rail, and (2) whether this speed would approach or possibly fall below the maximum recorded slipping speed of 120 m. p. h. on this class of engine, a program of slipping tests was formulated and conducted in April, 1938, on a short stretch of main-line track with a train of eight cars for trailing load. The rail was 127-lb. section on rock ballast as later described under "Track Tests, L-2d Converted."

To promote slipping, the heads of both rails were greased before each run for a distance of 230 ft. Scratch gages to measure rail deflection and movement of driving boxes with respect to frame were located at marked positions on the rail and on the locomotive. The train speed and the maximum revolving speed of the driving wheels during slips were obtained by a positively driven electrical speed indicator of the Weston generator type, and high-speed motion-picture cameras were used to record any lifting of the wheels from the rail.

Table IV—Smokebox Tests for J-1 and J-3 Locomotives at Maximum Evaporation Rate

	J-1 Class		J-3 Class	
	Original	Improved	Original	Improved
Coal fired per hour, lb.	12,300	14,500	14,700	14,200
Coal fired per sq. ft. of grate area per hr., lb.	151	178	179	173
Water evaporated per hr., lb.	76,800	85,500	84,500	92,000
Increase, per cent	...	11.30	...	8.90
Evaporation per pound of coal fired, lb.	6.24	5.89	5.76	6.48
Exhaust passageway pressure, lb. per sq. in.	22.30	21.40	25.30	24.50
Decrease, per cent	...	6.40	...	3.20
Firebox draft, in. of water	2.70	3.40	2.80	3.20
Combined efficiency, boiler and superheater (dry coal basis) per cent	56.80	52.60	53.00	56.00
Diameter of basket-bridge exhaust nozzle, in.	6¼	7⅛	6¾	7

Four test runs were made at train speeds varying from 61 to 82 m. p. h. and with maximum slipping speeds of 123, 130, 135, and 164 m. p. h. while working steam. In the three tests at the lower speeds, there were no indications that the wheels had lifted. In the final test at 164 m. p. h., the main drivers definitely left the rail and later examination disclosed a number of very slight markings on the rails which were without significance and had no disturbing effect on the track structure requiring attention of maintenance forces.

No damage to the locomotive occurred in any of these tests and the two questions postulated were definitely answered because the rotational speed of 164 m. p. h. necessary to lift the wheels from the rail exceeded by 44 m. p. h. the highest known slipping speed of these engines.

Subsequent Improvements in Boiler Capacity and Engine Efficiency

In the year 1937, a series of standing tests was undertaken to determine the extent to which improvement in capacity and efficiency of the class J-1 and J-3 boilers and cylinders could be secured by redesign of the smokebox arrangement. The primary objectives were to increase the capacity of the boiler, accompanied by a reduction in back pressure, which would be reflected in increased cylinder horsepower and efficiency.

Table V—Smokebox Tests for J-1 and J-3 Locomotives Average Values

	J-1 Class		J-3 Class	
	Original	Improved	Original	Improved
Coal fired per hour, lb.	7,131	7,131	7,175	7,175
Coal fired per sq. ft. of grate area per hr., lb.	87.5	87.5	87.5	87.5
Evaporation per pound of coal fired, lb.	7.87	7.90	7.89	7.82
Exhaust pressure, lb. per sq. in.	12.5	10.3	12.0	9.3
Decrease, per cent	...	17.6	...	22.5
Firebox draft, in. of water	1.8	2.2	1.6	1.4
Combined efficiency, boiler and superheater (dry coal basis), per cent	68.5	70.0	69.4	67.8
Combustion efficiency (dry coal basis), per cent	86.0	87.8	86.0	88.1
Diameter of basket-bridge exhaust nozzle, in.	6¼	7⅛	6¾	7

Several different smokebox arrangements were tested during these experiments, which were first conducted on J-1 No. 5224 at the Selkirk engine terminal.

Tables IV and V outline briefly the principal results‡

* Paper contributed by the Railroad Division and presented at the semi-annual meeting of The American Society of Mechanical Engineers at Kansas City, Mo., on June 17, 1941. Part I appeared in the August issue.

† Chief engineer, motive power and rolling stock, New York Central.

‡ For a description of the apparatus used and results obtained see "New York Central's Standing Locomotive Tests," *Railway Mechanical Engineer*, Part I, Feb., 1941, pp. 56-59; Part II, March, 1941, pp. 96-100.

for both the J-1 and the J-3 classes, the data being given at maximum evaporation rates and also for an average firing rate of about 7,100 lb. per hr. corresponding to 87.5 lb. of coal per hr. per sq. ft. of grate area.

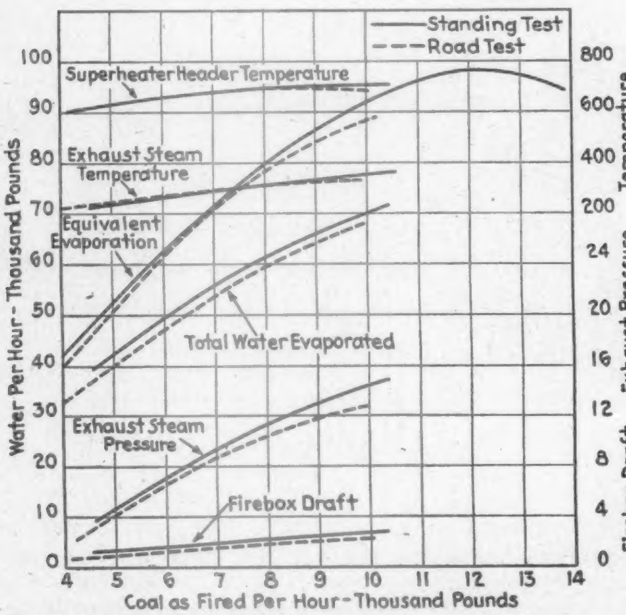


Fig. 4—Comparative results of standing tests vs. road dynamometer tests for Class J1 locomotive No. 5224 with original front end and 7⅜-in. exhaust nozzle

Fig. 4 has been prepared to show graphically the results from a road dynamometer test and a standing test for the same class J-1 locomotive with identical arrangement of smokebox, firebox, and exhaust nozzle, illustrating the close degree to which the standing tests duplicate the thermal conditions which occur when steam is used during road operations.

As a result of the experiments, installations of the improved design of front-end arrangement have been proceeding and approximately 520 engines are now equipped.

Conversion of Two 4-8-2 Locomotives for Passenger Service

With the full complement of 275 Hudson-type locomotives on the New York Central, it was found that the passenger traffic could be handled satisfactorily under normal conditions but that, during peak periods in the holiday seasons, it was necessary to use some of the older K-3 locomotives for the excess traffic. As these units were gradually retired and assigned to secondary or branch-like service, there remained an insufficient number available for this supplemental operation, and as the trains handled often demanded greater power than these engines possessed, they were not satisfactory for this purpose.

For these reasons the 4-8-2 Mohawk type freight engines, Class L-2, were occasionally used in emergency passenger service during heavy-traffic periods but were limited to 60 m. p. h. due to riding qualities and the difficulty of maintaining satisfactory running conditions with the friction-bearing driving boxes.

These engines were built during the years 1926 to 1930. When the acquisition of new freight power was lately under consideration, necessitating complete review of the design, with a number of important changes, the question arose as to whether the new design could be so arranged as to preserve the general character of freight locomotives and at the same time serve satisfactorily in passenger service during periods of peak traffic. Such additions to the freight motive power would also accomplish an increase in the available passenger power without actually involving additional units, designed especially for passenger service.

Consideration was given to the design and construction of a sample locomotive to be given a thorough test and trial but, because of the time involved and the complications usually present in an undertaking of this kind, it was decided that one or two of the L-2 class should be converted for high-speed passenger service, thus making possible early development of experience background for the design of the new engines, an order for which could then be placed without undue delay.

Two of the L-2 class, Nos. 2995 and 2998, were selected for this purpose and the following principal changes were made to provide satisfactory operation in passenger service at speeds of 80 m. p. h. and at the same time maintain suitability for freight operation equal to the L-2 class: (1) Boiler pressure increased from 225 to 250 lb. per sq. in.; (2) cylinder diameter reduced from 27 in. to 25½ in. for starting tractive force equal to the L-2; (3) lightweight reciprocating parts; (4) dynamic counterbalancing of all drivers; (5) roller bearings on engine truck, tender truck, and drivers on No. 2998; (6) roller bearings on engine truck and tender truck on No. 2995; (7) coal pushers in tender; (8) lateral-motion device on front drivers; (9) improved radial buffers between engine and tender and, (10) cast-steel pilots and drop couplers.

The weights before and after conversion were as follows:

	L-2 Freight	L-2 Converted
Weight in working order, lb.:		
On engine truck	59,150	65,400
On drivers	250,000	257,000
On trailing truck	61,000	62,700
Total engine	370,150	385,100

The two locomotives were released for service in August, 1939, and have been successfully handling main-line passenger trains since that time, except that one of them was removed from service for exhibition at the World's Fair throughout the 1940 season. As of December 31, 1940, a total of 200,000 miles had been accumulated on the two engines and no special difficulties of operation or maintenance have been experienced during this period of service. Table VI shows the dimensions and principal characteristics of the converted engines.

Track Tests, L-2d Converted

The weight of the two converted class L-2 locomotives had been increased about 15,000 lb. over the standard L-2 and it was essential to determine whether these engines, with 69-in. driving wheels and the modifications referred to, could be operated at the passenger-train speed of 80 m. p. h. without imposing excessive stresses on the track structure. For this purpose, track tests were conducted in September, 1939, which included one of the J-1 class as well as the two converted engines, in order to obtain comparative information, as the J-1 class, during approximately 200,000,000 miles of operation, had never been known to produce any harmful effects on the track.

Two 170-ft. test sections were used, located about one-half mile apart on the inside westbound high-speed main track of a 4-track system. Both sections are on an ascending grade of 0.315 per cent, one comprising tan-

gent track and the other a curve of 1 deg. 8 min. selected so that each test was run continuously over both sections without reduction in speed for the curve.

The rail was 127-lb. New York Central standard section laid on sound creosote-treated ties spaced about 1 ft. 8 in. center to center with canted tie plates having an outside shoulder only. The ballast was 2-in. crushed rock.

Strain gages placed in groups at 10-ft. intervals were used to measure the stresses in the rails on the outside of the rail head, underneath the rail at the center line, and on top of the outer and inner flanges. Slow-motion pictures were taken at each test section to determine the position of the crankpin for each stress recorded.

The results showed that up to 87 m. p. h. the maximum speed operated, the converted L-2 imposed no greater stress on the track than the J-1 and that the maximum stresses in both cases were well within permissible limits, proving that such a locomotive with 69-in. driving wheels could be operated at the same maximum speeds as the one with 79-in. drivers and substantiating the correctness of the method of balancing used for the converted L-2, which had taken into account the complete theoretical analysis. In this work much valuable assistance was rendered by the Timken Roller Bearing Company.

The ranges of comparative stresses for the two locomotives and for one of the J-3 class tested at the same time are given in Table VII.

Table VI—Characteristics and Principal Dimensions of Converted L-2d Locomotives and Latest Combination Freight and Passenger Locomotive, Class L-3a

Class	L2d (conv.)	L3a
Type	4-8-2	4-8-2
Year built	1930	1940
Year converted	1939	....
Cylinders, number, diameter and stroke, in.	2—25½ x 30	2—25½ x 30
Wheels, diameter outside tires, in.:		
Driving	69	69
Max. tractive force, engine, lb.	60,100	60,100
Max. tractive force, booster, lb.	13,750	.....
Weights in working order, lb.:		
On drivers	257,000	262,000
Total engine	385,100	388,500
Tender:		
Water capacity, gal.	15,000	15,500
Fuel capacity, tons	28	43
Trucks	Six-wheel	Six-wheel
Boiler:		
Steam pressure, lb. per sq. in.	250	250
Diameter, first ring, inside, in.	82⁷/₁₆	82⁷/₁₆
Diameter, largest outside, in.	94	94
Grate area, sq. ft.	75.3	75.3
Heating surfaces, sq. ft.:		
Evaporative	4,556	4,676
Superheating	1,931	2,082
Comb. evap. and superheat.	6,487	6,758
Wheel bases, ft.-in.:		
Driving	18—0	19—0
Engine, total	42—1	43—1
Horsepower:		
Max. indicated	4,200 at 50 m.p.h.	4,400 at 55 m.p.h.
Max. drawbar	3,640 at 43 m.p.h.	3,800 at 48 m.p.h.

New L-3 Combination Passenger and Freight Locomotive

On the basis of the experience gained with the two converted L-2 engines and the study that had been given to the design, with the close cooperation of The American Locomotive Company, the Superheater Company, the Timken Roller Bearing Company, and others, 50 of the L-3 class were ordered and have lately been delivered,* 25 of which are arranged for operation in either passenger or freight service, while the remaining 25 are strictly freight locomotives but having the same characteristics with respect to speed versus track structure. The combination engines are equipped with a cast-steel pilot and drop coupler, steam heat, air signal, engine-truck brake, and roller bearings on all wheels including drivers. Boosters were omitted although arrangements were made for convenient application if subsequently found desirable.

The 4-8-2 wheel arrangement was retained as it was found that for this design the required weight distribution could be secured without the use of a four-wheel trailing truck and also because it was desired to supply the largest possible tender, particularly with reference to coal capacity, without extending the over-all length of engine and tender beyond the limits of the 100-ft. turntables now in use at principal main-line terminals.

The extra large coal capacity of 43 tons was provided to increase materially the length of runs and through intensive use to obtain high monthly mileage which would be equivalent to additional locomotives.

A waterscoop of improved quick-acting design, which had recently been developed and tested, and which supplies approximately 20 per cent more water with a substantial reduction in the amount spilled, was applied.

The standard 69-in. driving wheels were retained as experience had proved this size best for high-speed main-line freight service in which the engines would be used the greater portion of the time. Provision was made, however, by increasing the driving wheel base and the over-all length, for the future application of 72-in. driving wheels, as a margin of protection for high-speed running.

For reasons beyond the scope of this paper, it was decided to use carbon steel instead of nickel steel for the boilers and, in order to conform to the desired limits of total weight and wheel loads, this necessitated using a working boiler pressure of 250 lb. per sq. in. instead of the 275 lb. per sq. in. originally planned. With this pressure and cylinders of 25½-in. diameter and 30-in. stroke, a rated starting tractive effort of 60,100 lb. was obtained, about equal to the 60,620 lb. of the L-2 class as desired.

The increase in driving wheel base permitted the use of a combustion chamber 12 in. longer than on the L-2

Table VII—Summary of Maximum Stresses; Tangent Section

Locomotive	Speed range m.p.h.	Rail	No. of stresses above 15,000 lb. per sq. in.	Five highest maximum stresses, lb. per sq. in. — Average	Five highest maximum stresses, lb. per sq. in. — Range
		(Strain-gage located underneath the rail)			
2995 L-2d (conv.)	54.4 to 87.2 (9 runs)	Left (S)	64	21,400	22,100 to 20,900
		Right(N)	17	18,800	23,300 to 17,100
5330 J-1e	66.2 to 85.9 (5 runs)	Left (S)	34	21,200	22,600 to 19,500
		Right(N)	16	18,800	20,500 to 17,800
5435 J-3a	72 to 83.2 (4 runs)	Left (S)	21	24,200	29,100 to 20,200
		Right(N)	11	19,200	20,800 to 18,300
		(Strain-gage located outside of head of rail)			
2995 L-2d (conv.)	54.5 to 87.2 (9 runs)	Left (S)	43	20,500	23,000 to 18,500
		Right(N)	26	20,200	23,400 to 18,600
5330 J-1e	66.2 to 85.9 (5 runs)	Left (S)	33	19,400	20,500 to 18,500
		Right(N)	20	22,000	27,700 to 19,100
5435 J-3a	72 to 83.2 (4 runs)	Left (S)	19	17,700	18,400 to 17,400
		Right(N)	10	19,500	22,000 to 18,400

* "New York Central Buys 50 4-8-2 Type Locomotives," *Railway Mechanical Engineer*, January, 1941, pp. 1-8, 21.

for increased firebox volume and greater combustion efficiency; greater gas area through an enlarged superheater was provided to increase the superheat temperature. An improved front end, as developed by the Selkirk tests heretofore mentioned, was installed. Particular attention was given to the proportioning of steam passages from dome to exhaust to provide free steam passage and reduce transmission losses, and the large-volume steam chest with the standard 14-in. valves was retained.

Reciprocating parts are of special lightweight design similar to those used on the two converted L-2 class, and all wheels were dynamically balanced in accordance with the theoretically correct principles established for those engines.

The following modifications were made with a resulting decrease in weight: USS Cor-Ten steel main air reservoirs; aluminum cab, running boards, cylinder and valve casings, dome and turret casings, and gage board; high-tensile-steel drop coupler; lightweight magnesia block lagging; tubes and flues to one gage tolerance and, new design lightweight valve gear.

Other special features incorporated were complete speed-recorder and cut-off selection equipment, coal pusher, Alemite grease equipment for rods and other parts, roller bearings on all axles, and lateral-motion device on front and main drivers.

The estimated drawbar pull and horsepower versus speed for the L-3 are shown by the curves included in Fig. 2. Capacity and performance tests for the L-3 are now in progress and the characteristics shown are believed to be conservative. The principal dimensions and the proportions of the converted L-2d and the new Class L-3a locomotives are shown in Table VI.

Present Thoughts on Trends of Steam-Locomotive Design Improvement for the Near Future

While this paper is confined to the subject of the conventional steam passenger locomotive, the author is fully cognizant of the rapid strides being made by other forms of motive power, their possibilities, advantages, and growing importance to the railroads for certain classes of service.

This may be illustrated by stating that on the New York Central, 127 Diesel-electric locomotives are used in intensive daily service. As early as 1924, a 60-ton 300-hp. Diesel-electric locomotive was operated in switcher and puller service in New York City territory with favorable results, followed in 1928 by a road freight and in 1929 by a road passenger locomotive. The first straight electric was introduced in 1904, and there are now 168 of various types and capacities in use on the System. Within the last 6 years, limited operating experience has been obtained with a 5,000-hp. experimental turboelectric locomotive and a 3,600-hp. Diesel-electric, both designed for high-speed main-line service, and a 5,400-hp. Diesel-electric freight locomotive.

Future development of the steam locomotive in some radically new form, such as the steam-turbine condensing or combustion type, as recently proposed, should show a substantial increase in thermal efficiency but, until the stage has been reached where such units of proved dependability in daily operation can be produced of moderate size, weight, and cost, it is the author's belief that basic lines of development should be continued by taking advantage of the possibilities for further betterment of the conventional reciprocating design without radical changes in the type of boiler or resorting to the mechanical complication of multiple expansion of steam. It should be possible now to produce a highly serviceable two-cylinder single-expansion locomotive of the 4-8-4 type at a weight per indicated horsepower closely approaching that represented by the 4-6-4 class J-3a described in this paper, capable of delivering 6,000 cylinder hp. when required.

Such a design should include the largest practicable superheater, with ample firebox volume and grate area, carefully proportioned steam passages from boiler to exhaust, and a working steam pressure probably up to 300 lb. per sq. in.

Roller bearings on all locomotive and tender axle journals and to a lesser degree in rods and motion work have resulted in increased serviceability because of freedom from heating failures. Their extended utilization should receive careful consideration.

For the future extension of steam-locomotive productive capacity, design study leading to a better proportioned and more efficient boiler is proposed. The development of a suitable drier arrangement to provide high-quality steam, taken directly from the boiler barrel, would permit elimination of the steam dome with corresponding possibilities within given weight or clearance limitations for increased diameter of barrel with improved tube and flue layouts and larger gas areas and superheater, additional firebox depth and volume, and more nearly level grates without restricting the highly important features of adequate ash-pan capacity and arrangement necessary for long locomotive runs.

Table VIII—Summary of Principal Weight and Power Characteristics for Locomotive Designs Discussed

Class	Type	Last built	Locomotive weight lb.	Maximum horsepower and speed (m.p.h.) at which attained: Cylinder	Drawbar	Weight per-horsepower, lb.: Cylinder	Drawbar
K-80	4-6-2	1912	252,500	1,700-39	1,430-35	149	177
K-2	4-6-2	1910	273,000	2,000-45	1,655-40	137	165
K-3q	4-6-2	1923	295,500	2,100-45	1,720-40	141	172
K-3r	4-6-2	1925	278,000	2,140-45	1,750-40	130	159
K-5	4-6-2	1926	302,000	3,200-54	2,530-45	94	119
J-1a No. 5200	4-6-4	1927	343,000	3,900-67	3,300-58	88	104
J-1e	4-6-4	1931	358,600	3,900-67	3,240-58	92	111
J-3	4-6-4	1937	360,000	4,725-75	3,880-65	76	93
Converted L-2	4-8-2	1930	385,100	4,200-50	3,640-43	92	106
L-3	4-8-2	1940	388,500	4,400-55	3,800-48	88	102

Design studies and performance experiments are now in progress to improve the poppet-valve arrangement of steam distribution and these efforts may result in making available for practical use the better cylinder performance in relation to power output and efficiency inherent therein, without prohibitive increase in the size and weight of the boiler.

Other interesting experiments now in operation include locomotives having four simple cylinders and two separate sets of running gear or combined within a single rigid wheel base, with which improved wheel loadings and rail effects should be obtained, together with lower dynamic forces in machinery and running-gear parts, as well as other advantages.

Ability to extend the length of locomotive runs in either freight or passenger service without stops for fuel depends to a great extent upon the size of the tender. This, in turn, may be limited by possible restrictions on over-all length. One leading western railroad now has in service back of a considerable number of modern design steam locomotives a new arrangement of tender running gear and underframe which possesses possibilities of materially increased tender capacity within given dimensional restrictions.

Discussion

R. M. Ostermann, vice president, The Superheater Company, in discussing Mr. Kiefer's paper, said in part:

"In the paragraph entitled, "Thermal Efficiency at Tender Drawbar Referred to Fuel," the author explains the circumstances which led him to compromise between thermal efficiency and practical operating advantages, and he thus exhibits the very logical view of a railroad operating man. However, the engineer sitting on the sidelines wonders whether steam locomotive designers will not eventually be forced to far-reaching modifications of the design of steam locomotives because of the pressure of the competition that the conventional steam locomotive encountered from the Diesel locomotive which has a great advantage in thermal efficiency. Steam-locomotive designers may be forced, in self-defense, in their future designs, to embody some of the principles, the application of which has produced such eminent progress in the economy of stationary power plants within the last 15 years. For instance, it is seen that the J-3 engine, at its best, works with a heat drop per pound of steam of about 160 B.t.u. It is not at all unreasonable to expect that steam locomotives may some day be worked with nearly double that heat drop in an entirely practical manner, as I have pointed out more in detail elsewhere.

"It is perfectly true that in railroad locomotives, as Mr. Kiefer points out, we are confronted with acute limitations of weight, height, width and length of structure, but it seems to me that just because of them, one should try every physical means in order to get a maximum of capacity into a given cubic space.

Frank E. Russell, mechanical engineer, Southern Pacific, in commenting on Mr. Kiefer's paper, stated that the Southern Pacific was more fortunate with respect to combustion losses and absorption efficiency because the combustion efficiency with oil fuel is high and there is only a small decrease in over-all boiler efficiency as the firing rate is increased which permits high power outputs with a moderate draft and back pressure. He considered the design of steam and exhaust passages especially important and credited much of the increase in horsepower per unit volume in the more recent locomotives to careful cylinder design having definite steam, exhaust and valve bushing area in relation to piston size. Continuing Mr. Russell said:

"Prior to 1927 apparently little attention was paid to increasing the area of exhaust passages in the cylinders in proportion to the cylinder diameter, resulting in high back pressure and low power output at high speeds. During that year we made an analysis of the proportion of exhaust passages as related to piston area, and since then all our locomotives have been built with improved exhaust passages, resulting in increased horsepower output and reduced back pressure and fuel consumption.

"In 1920 we made dynamometer tests on 2-10-2 type locomotives equipped with superheaters and determined that for superheated locomotives we should get away from saturated steam practice and that in order to obtain maximum fuel economy the cylinder diameter should be reduced and the stroke increased over the proportions normally used at that time. In 1921, when we purchased our first heavy Pacifics for service between Sparks, Nev., and Ogden, Utah, handling heavy transcontinental trains, we went to a 30-in. stroke with 25-in. cylinders, using 73-in. drivers. These locomotives were so satisfactory in passenger service, not only in high-speed hauling capacity but also in their ability to start heavy trains without taking slack, that we have continued the practice of using a relatively long stroke. Our latest 4-8-4 type locomotives have 25½-in. by 32-in. cylinders with 80-in. drivers, and we find these proportions very satisfactory for starting heavy trains and for high-speed full-power operation.

"Given a boiler designed for high-power output and high superheat, and steam and exhaust passages capable of handling the steam required for high power output, the remaining problem is that of utilizing this steam with the greatest efficiency in the cylinders. In this regard the present form of piston valve with interconnected timing of events is certainly not ideal, and I confidently look forward to the perfection of some form of valve with independent timing to obtain more adequate valve openings at high speeds and short cut-offs, together with a reduction in the present distortion of exhaust events. In this regard, the poppet valve gear mentioned in Mr. Kiefer's paper is of great interest, and I believe very promising.

"As an example of what a modern high-power steam locomotive can do, I have analyzed some of the performance records of our latest 4-8-4 type passenger locomotives purchased in 1940. These locomotives have cylinders 25½-in. by 32-in., 80-in. drivers, and carry 300 lb. per sq. in. boiler pressure. They are equipped with Type E superheaters, Worthington SA feedwater heaters and have oil lubrication on all axle bearings. These locomotives are used to handle the streamline "Daylight" trains between San Francisco and Los Angeles, Calif., which frequently have 16 cars, weighing 924 tons loaded. On these trains, the portion of the run that requires the highest power output is on the eastbound run from Camarillo to Santa Susanna, Calif., 20.9 miles, with an average opposing grade over the entire district of 0.75 per cent. Between these points the schedule speed is 62.7 m. p. h. Examining the speed recorder tapes, I find that on one seven-mile continuous stretch of compensated one per cent grade, the maximum speed maintained steadily is 55 m. p. h. with the 16-car, 924-ton "Daylight" train, which requires a calculated drawbar horsepower on level track of 4,750; the equivalent cylinder horsepower is estimated at 5,400. On other occasions these locomotives have handled the "Daylight" with 13 cars, weighing 729 tons, on the 2.2 per cent Cuesta grade, making speeds of 28 m. p. h. without a helper. On our Salt Lake division, a slightly older type of 4-8-4 locomotive is handling trains of 20 cars, weighing approximately 1,400 tons, on fast schedules."

T. V. Buckwalter, vice-president, Timken Roller Bearing Company, compared the K-80 locomotives with the J-3a class, pointing out that the improvement of from 1,430 to 3,880 drawbar horsepower was made in the short span of 33 years, the power development of 1937 being 2.71 times that of 1904 or an 8.2 per cent annual increase. Continuing, Mr. Buckwalter said, in part:

"The Hudson-type locomotive was further improved in 1937, increasing capacity in drawbar horsepower to 3,880, or 17 per cent. This, in itself, is an outstanding improvement, considering that the weight on the drivers of the J-3a is only 11,000 lb. more than that of the J-1-E, while the actual engine has only 1,400 lb. additional weight. The use of the lightweight reciprocating parts, effecting a reduction of over 50 per cent in weight, afforded an opportunity to redistribute the counterbalance, the typical practice being to distribute two-thirds to three-fourths of this reciprocating weight reduction to decreasing the counterbalance, and, therefore, the dynamic augment on the rail, and utilizing the balance to reduce nosing. Together, these have an important influence on improved riding of the locomotive and also reduce rail reaction. As Mr. Kiefer mentions, the Hudson-type locomotives have operated 200,000,000 miles with-

out a single case of rail damage attributable to this class of locomotive.

"Probably the principal improvement in steam passenger locomotives is the increase in capacity for work as measured in ton-miles per month. The average mileage of the 50 J-3's for the month of December, 1940, was 11,689 miles each. Ten of these locomotives actually made over 16,000 miles in that month. It is doubtful whether the average passenger locomotive previous to 1925 averaged more than one-third the above figure in hauling trains approximately half as heavy when the power required for air conditioning equipment is considered. This would indicate that the modern Hudson-type locomotive has six times the capacity for work as compared with the locomotive of only 15 years ago. This is a noteworthy development and affords a further indication that the replacement of the steam passenger locomotive by other forms of motive power is still a long distance in the future.

"Much thought was given to the conversion Class L-2 locomotive No. 2998. The reciprocating weight was reduced from 2,143 lb. to 1,239 lb., a reduction of 904 lb. The overbalance in the plane of the rail on the left main driver was reduced from 441 lb. to 171 lb. and the corresponding dynamic augment at diameter speed from 21,200 lb. to 8,220 lb., a reduction of 12,980 lb., or 158 per cent of the remaining dynamic augment.

"The rail reaction on the main driver at 75 m. p. h. was reduced from 28,100 to 8,200 lb. upward against the spring rigging, and from 24,000 lb. to 12,200 lb. downward against the rail. The nosing moment was reduced from 8,400,000 inch pounds to 4,000,000 inch pounds at 80 m. p. h., and the fore-and-aft shaking force from 108,000 lb. to 64,000 lb. These figures are reflected in the relatively low rail stresses at speeds up to 87 m. p. h. as indicated in the table, "Summary of Maximum Stresses," included in Mr. Kiefer's paper. The Class L-2 locomotive with 69-in. drivers, balanced as above, compares favorably with the J-1-E and J-3-A Hudson-type locomotives at high speeds with respect to lower stress in the rails and good riding qualities.

"The New York Central J-3-A and L-3-A locomotives afford an additional interesting comparison in the design of the main pedestal openings. The J-3-A driver bearing application is based on interchangeability with other types of roller bearings. The pedestal opening of 28¾ in. and pedestal clearance of 16 in. above the center line of the axle are derived from the space requirements of other roller bearings.

"The L-2-D and L-3-A pedestal opening is based on the space requirements of the taper roller bearing of the double row type having a pedestal opening of 21¾ in. and pedestal clearance of 13⅝ in. which interchanges exactly with the plain bearing requirements. In addition, there are outstanding reductions in unsprung weight and provision of more space for spring rigging with the advantages of an equal degree of reliability and greater economy in the plain bearing interchangeable layout. Most of the current locomotive construction is based on this interchangeable layout."

James Partington, manager, engineering department, American Locomotive Company, pointed out that the New York Central, to keep within weight limits on the L-3 locomotives, made the cabs, running boards and dome casings of aluminum and on the J-3 locomotives, all of the important casings were aluminum with cabs of aluminum on 40 locomotives and of USS Cor-Ten steel on 10. "Here," he said, "we have a situation where the saving of weight was urgently necessary and the use of expensive material was resorted to for a weight saving of about 2,000 lb. per locomotive.

"Twice this saving would be obtained if the boilers of these locomotives were of welded construction. I would, therefore, like to discuss briefly the welded boiler for locomotives.

"Soon after the rules for fusion welding were adopted by the Boiler Code Committee of The American Society of Mechanical Engineers, they were placed in the Code for Power Boilers. The use of these rules proved them to be safe and satisfactory, and after several years' experience, the Code Committee suggested that they be adopted for the locomotive boiler code.

"After several conferences with the Bureau of Locomotive Inspection, Interstate Commerce Commission, and largely through the efforts of the late L. F. Loree, then president of the Delaware & Hudson, permission was granted to this railroad to build and operate a locomotive with a welded boiler. This boiler was built by the American Locomotive Company to meet the requirements of the A. S. M. E. Power Boiler Code, and the locomotive was placed in freight service on the D. & H. in the fall of 1937. This welded boiler will soon have a service record of four years, and during this time very complete and thorough inspections have shown that it has a performance record of 100 per cent.

"When the I. C. C. gave its permission for the operation of this locomotive with a welded boiler, it was in response to a request sponsored by many of the leading railroads that an experimental installation be allowed. In granting this request it was stipulated that no additional welded boilers would be permitted pending a test period of five years. For the operation of additional locomotives with welded boilers, the railroads will have to secure authorization from the I. C. C. through a procedure similar to that used by the D. & H. for this first welded boiler.

"The advantages of the welded locomotive type boiler are as follows: No rivets; no overlaps; no obstructions inside or outside; no joint repairs or failures; lower upkeep expense; higher efficiency; lighter weight; easier handling; quicker washing; neater appearance, and the elimination of caustic embrittlement, which has caused rivet failures and cracked sheets in the region of both circumferential and longitudinal seams of riveted boilers. The latter, in a number of cases, has made expensive repairs necessary.

"Welding has supplanted riveting for high-pressure stationary boilers and for nearly all pressure-vessel construction. There are several hundred locomotive type welded boilers in use for power purposes in the United States, and these boilers are operating at pressures up to 350 lb. per sq. in.

"Will more welded boilers for locomotives be built? This will depend on the attitude of the railroads and the decision of the I. C. C. The locomotive builders are ready to give full assistance and cooperation in this development."

J. E. Long, western sales manager, Franklin Railway Supply Company, commented on the fact that all of the authors seemed to have one thought that stood out above all others, that is, the horsepower capacity of the motive-power unit. "Mr. Kiefer's paper showed," he said, "how the K-80 locomotives of 1904 produced 28,500 lb. tractive force and 1,700 cylinder horsepower at 39 m. p. h. while the J-3 locomotives of 1937 produced 43,440 lb. tractive force but delivered 4,725 cylinder horsepower at 75 m. p. h. This is an increase of only 52 per cent in tractive force but an increase of 178 per cent in horsepower. Weight per cylinder horsepower was reduced from 132 to 76 lb. in that time.

"The program of power development is controlled by three main factors. These are the efficiency and ca-

pacity of the boiler, the efficiency and capacity of the cylinders, and the efficiency of the machinery. While the boiler has been improved, about the only important steps taken to improve the cylinder performance are superheating and some small improvements in steam distribution but still using the sliding or piston valve."

Mr. Long continued with a description of the development of the Franklin steam distribution system and included a summary of the road tests and test plant results obtained with a Pennsylvania Pacific type passenger locomotive equipped with this steam-distribution system*. In discussing the improvement in power and in economy to be obtained from this poppet-valve system, Mr. Long pointed out the value of this development under present emergency conditions. He stated that the application of the new steam-distribution system would produce large increases in the horsepower capacity of the motive power inventory of railroads in the shortest possible time and with the least cost. Continuing, Mr. Long said, in part: "In new locomotive design to meet a definite power requirement, the application of this distribution system will result in reduced locomotive weight. On the Pennsylvania locomotive No. 5399, weight for indicated horsepower was reduced from 91 to 79 lb. On various types of locomotives which have been studied in recent months the following examples show the possible reduction in weight per horsepower:

Type	Locomotive weight, lb. per i.hp.	
	Piston valve	Poppet valve
4-6-2	100	89
4-6-4	90	75
4-8-4	104	85
2-10-4	103	86

"The practical proof in the improvement of power output is the fact that the Pennsylvania instructions are not to double-head locomotive No. 5399 but to assign it to important and fast trains where the consist exceeds the normal locomotive rating by two cars. This is roughly an increase of 20 per cent."

C. J. Surdy, assistant to general manager, Standard Stoker Company, stated that present-day traffic, in many instances, is seasonal and during such periods there is a heavy demand for high-speed power in both passenger and freight service. He commented on the fact that few, if any, railroads can afford to hold power in reserve to meet such seasonal demands and, therefore, it is quite evident that the solution of this problem is the dual service locomotive described in Mr. Kiefer's paper.

"Of more than usual interest, said Mr. Surdy, is that portion of Mr. Kiefer's paper in which he presents his thoughts on trends of steam locomotive design and improvement for the future. With the experience on the New York Central, including the experimental use of a 5,400-hp. Diesel-electric and a 5,000-hp. turbo-electric locomotive, Mr. Kiefer's endorsement of the conventional reciprocating locomotive should be regarded by motive-power designers as a challenge. Apparently, his choice of motive power is made on the basis that nothing better has yet been offered when due consideration is given to all factors.

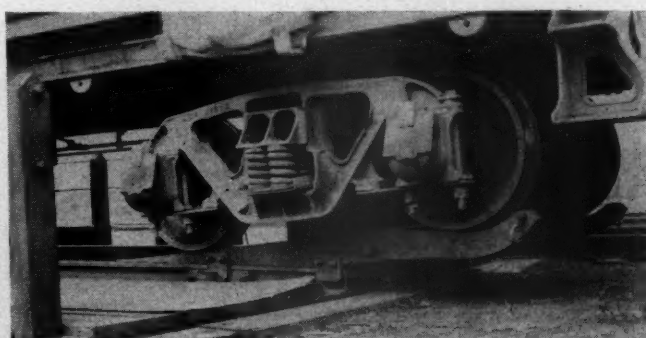
"There is much more to consider in the selection of motive power than the known advantages which are derived from more expensive power such as Diesel-electrics or turbo-electrics of the experimental type proposed in recent years. Practical railroad men must also give full consideration to the economic forces which in a considerable measure determine whether or not coal must be used as a source of power. They must take into account the effect which their use of certain kinds of coal may have on the consumer market which their railroad serves. Obviously, to take off the market coal that is desired by the consumer only results in loss of the haul to the railroad. In 1939, bituminous coal accounted for one-sixth of the total railroad freight revenue in the United States. From this it appears the railroads need the coal freight haul while the coal mine operators apparently need the railroad's fuel business to stabilize their output.

"On the premise that many railroads will continue to regard coal as a primary fuel for their motive power, it appears that sufficient incentive exists for locomotive designers to give more thought to producing a coal burning motive unit with the characteristics of the Diesel-electric. Some work of a preliminary nature has been done in this respect, but apparently the development is not complete.

"It is not within the scope of this discussion to promote a new system of motive power, but Mr. Kiefer's paper, which takes up step by step through the development of steam locomotives on the New York Central, indicates that as greater demands are made for sustained power output of steam locomotives, more study will have to be given to some arrangement for increasing the diameter of the boiler barrel which will result in improved tube and flue layouts with larger gas areas and superheater. Since the diameter of the boiler cannot in any event, with steam locomotive design trends leading toward larger drivers, be increased greatly over present dimensions, the thought of other systems of motive power naturally arises.

"With the wide experience gained through the use of the locomotive boiler of simple construction and high steam generating capacity, a logical starting point for development of a turbo-electric locomotive is present. The boiler of a New York Central Hudson type locomotive can generate a maximum of about 100,000 lb. of steam per hour. By the use of a water-tube firebox it should be possible to generate steam at a pressure in the neighborhood of 700 lb. per sq. in. This capacity would exceed the steam requirements of two or even three 2,500-hp. turbines, so that a 7,500-hp. turbo-electric locomotive, using coal as a primary source of fuel in a boiler and firebox somewhat along present conventional lines, is within the realm of possibilities."

* * *



Courtesy of Illinois Central Magazine

This extension has been applied to the turntable of the Illinois Central at Jackson, Tenn., in order to handle locomotives whose lengths are too great for the original facilities

* A description of the Franklin poppet valve gear appeared on page 349 of the September, 1939, issue of the *Railway Mechanical Engineer.* A description of the road tests and a summary of the test results made with a Pennsylvania Class K4s Pacific type locomotive, No. 5399 was published in the *Railway Mechanical Engineer,* April, 1941, page 125. A description of the series of tests on the Pennsylvania Railroad test plant at Altoona, Pa., with this same locomotive was published in the *Railway Mechanical Engineer,* May, 1941, page 169.

Four Meetings at Chicago

Conventions of coordinated associations will be held at the Hotel Sherman, September 23 and 24

For the fifth time, the Railway Fuel and Traveling Engineers' Association, the Car Department Officers' Association, the Master Boiler Makers' Association, and the Locomotive Maintenance Officers' Association will meet at the Hotel Sherman, Chicago, on the same two days, September 23 and 24, under arrangements made by their own coordinating committee. Although the Allied Railway Supply Association will not exhibit during the meetings this year, there has been no let-down in the preparation of the programs for the meetings by any of the four railroad associations. Full programs of the meetings appeared on pages 310 to 313, inclusive, of the August issue.

Railway Fuel and Traveling Engineers' Association

The Railway Fuel and Traveling Engineers' Association has continued its record of highly constructive service to the steam railroad industry during the past year, with many of its activities proving definitely beneficial to the railway supply industry as well. The notably successful meeting in 1940 was publicized not only in the technical press, but through the distribution of 800 copies of the Proceedings which are neatly and attractively bound and present information of value on almost every phase of locomotive operating efficiency. A revised edition of the Examination Book, issued by this association, was published and released in October, 1940, 8,000 copies being printed and 3,500 of them distributed to date. This popular book contains over 1,200 questions and answers pertaining to locomotive operation and is designed to prepare enginemen and firemen for advancement as well as new men for employment.

The association has given further attention during the year to the important question of equating oil to coal as a fuel for locomotives in order that more accurate comparisons may be made and railway managements assisted in securing more efficient locomotive operation. In addition, the association is working with the A. A. R. Accounting Division on the question of fuel used by helper locomotives being charged to the actual train and service used instead of to other service. This will make for more correct and comparable fuel performance figures. On some roads, with air-conditioning power supplied from individual front-end power plants, the fuel used for this purpose is not charged against the train, but, in the case of axle-driven and steam-actuated equipment, the considerable amount of power and hence fuel required for air-conditioning is charged against the locomotive, thus militating against accurate comparisons. Also, the association is suggesting that a more accurate and satisfactory comparison of passenger locomotive performance may be made if fuel records are kept on a 1,000 gross ton-mile basis, as well as on a basis of passenger-train car miles.

The association has made real progress in promoting the attendance of air brake supervisors at its annual meetings, a total of 21 registering at the 1940 meeting. The program was designed to appeal to these men and the air-brake papers scheduled for presentation at this year's meeting also are of exceptional value to all those interested in brake problems. These papers are expected to bring out a sizable representation of air brake supervisors.

Master Boiler Makers' Association

For sheer vitality, the Master Boiler Makers' Association has had a record which is probably unequalled by any other of the so-called minor mechanical associations. Not large in point of membership, it is a close-knit body of men, a high percentage of whom enter actively into the work of their association in one way or another at some time during the year. For many years it has exercised a position of leadership in keeping its members advised of significant developments and trends pertaining to the maintenance and performance of locomotive boilers and, what is of even more consequence, has served to keep its entire membership actively conscious of their own responsibility with respect to these developments and trends.

One of the five topics on the program of the forthcoming meeting deals with chemical treatment of feedwater. This in its various phases, has been a subject of discussion before the meetings of the association for several years. It has been dealt with in committee reports, in individual papers, and in lectures in such a way that the boiler maker foremen of American railroads are almost as thoroughly conversant with the theory behind the various problems arising from the effect of feedwater on boiler interiors as are the specialists on the subject of feedwater treatment themselves. This year the treatment of this subject is along purely practical lines.

Another forwardlooking topic on the 1941 program deals with the application of iron, steel, and alloy rivets. This topic will deal with the entire chain of problems and the sequence of procedure involved in the use of the newer materials entering into locomotive boiler construction.

Car Department Officers' Association

The Car Department Officers' Association provides a forum, with an opportunity for each individual member to express his views and ideas, and give to others the benefit of his experience, thus eliminating to some extent the necessity of trial and error and making it possible for other members to avoid costly mistakes. Next to boilermakers and possibly fuel men, car supervisors are the most loquacious among mechanical-department representatives and this is particularly true when they start discussing interchange rules.

A. A. Raymond, President,

Railway Fuel and Traveling Engineers' Association

C. W. Buffington, President,

Master Boiler Makers' Association

A. J. Krueger, President,

Car Department Officers' Association

J. C. Miller, President,

Locomotive Maintenance Officers' Association

The C. D. O. A. reflects, in large measure, the views, desires and aims of car-department supervisors throughout the country and expresses its ideas in terms which will be readily understood not only by members of the association but by the rank and file of car-department employees on all railroads. By means of a carefully prepared year book, the constructive reports and discussions presented at annual conventions, are carried to those who for various reasons are unable to attend the meetings in person.

High points of the present Fall meeting of the C. D. O. A. will unquestionably be the addresses by E. B. Hall, chief mechanical officer, Chicago & North Western, on "Co-operation Between Railroads and Departments of Railroads;" address by W. D. Beck, district manager, Car Service Division, A. A. R., on "Conservation of Equipment;" address by D. S. Ellis, chief mechanical officer, Chesapeake & Ohio, on "Better Freight-Car Maintenance." It would be difficult to select any of this year's reports for special mention as they are all on highly pertinent subjects having a direct bearing on greater efficiency in car department operation.

The General committee of the C. D. O. A. held four meetings during the year and this was an important factor in making the association an aggressive, live organization, which is attempting to function during the entire year in the interest of the railroads. Still more effective work along this line is needed. One project initiated by the association during the current year is the organized attempt to develop and make available to all members information regarding the latest labor-saving devices, jigs, fixtures and shop tools, used in car departments throughout the country.

Locomotive Maintenance Officers' Association

Through three years this organization has been held together and its activities guided by the untiring efforts of a small group of officers. It is now almost through what might be called the pioneering stage during which its possibilities as an association within a field definitely limited to the problems involved in locomotive maintenance have been carefully explored by those who have been responsible for the formation of its policies. Looking back over the past two or three years it now appears that these men have been heading in the right direction. This year's program represents a distinct and significant change in the character of the Association's work; unlike the past two years the addresses and individual papers have given way to the preparation of a group of committee reports most of which are technical. One outstanding contribution that may be expected at this year's meeting will be the report on apprenticeship which will deal with a subject of unquestioned importance to the future of the railroads—the training of an adequate supply of skilled labor.

Given the right kind of leadership in the years just ahead this Association will develop into a constructive and useful organization within its specific field.

Aluminum Alloy Streamliners

(*Continued from page 340*)

of Los Angeles, with Timken roller bearings. Each of the roller-bearing journal boxes is equipped with a thermal-type heat indicator, electrically connected to a common relay for operating special audible and visible signals and the train air signal valve in each car. Truck clasp-brake equipment is of the Simplex unit-cylinder type with anti-rattling device. The brake levers are of high-tensile-steel, with Ex-Cell-O case hardened and ground brake pins and bushings. The brake shoes are the straight-face type, 9 in. long, four per wheel.

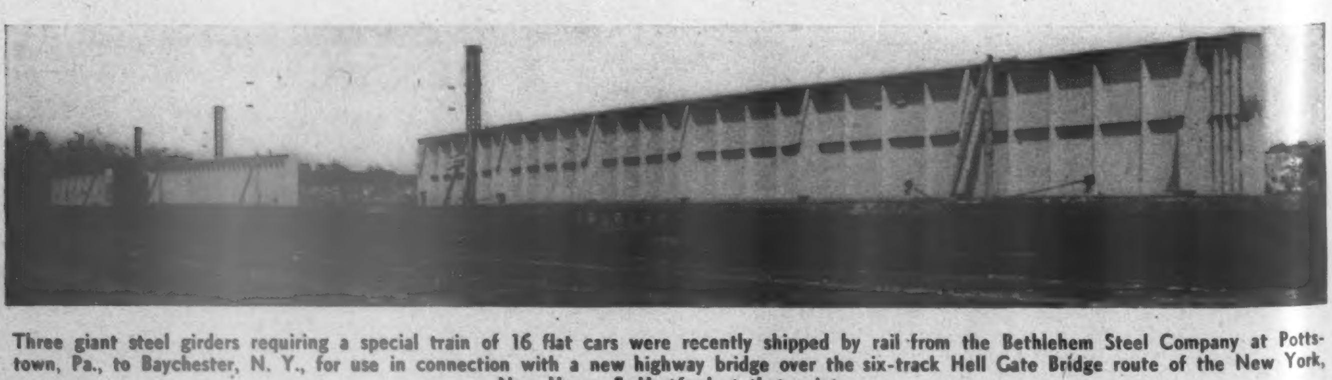
The decorative treatment as specified by the Pullman-Standard Color and Design Department, or, in the case of the car Hollywood, by Walt Kuhn, New York, and Mandel Bros., Chicago, is notable for the contrast of strong colors rather than subtle shades and blendings. Fluorescent lighting is carried around four sides of the dining and lounge rooms to suggest roominess. Mirrors, used extensively on the frieze and bulkhead panels, also give an impression of spaciousness by reflection.

In the car Hollywood, distinctly unique effects are secured. Plastics and synthetics have been used exclusively for decoration and appointments. Wall panels are constructed of Formica. The windows are of Polaroid glass and, by turning a knob, passengers can eliminate glaring sunlight without shutting off the view. Two synthetic products, Nylon and Saran, are used for furniture upholstery and coverings.

A typical color scheme is that selected for the articulated kitchen-dining car in the City of San Francisco. The basic color scheme for this car is burgundy, blue, coral and gray. The carpeting is in burgundy, with the dining chairs in gray-blue leather, draperies and window shades in coral, gray and blue, with horizontal pattern.

The wall has frieze panels of gray, pier panels finished in a light coral tone, and wainscotings of dark gray, Photomurals are used in the bulkheads at either end of the room, one pair of murals depicting the Golden Gate Bridge and the other pair showing the San Francisco-Oakland Bay Bridge. The photomurals are done in coral tones, hand colored to match with the tones of coral used in the draperies and window shades. Ceilings are pale coral, repeating the tones of the furnishings.

* * *



Three giant steel girders requiring a special train of 16 flat cars were recently shipped by rail from the Bethlehem Steel Company at Pottstown, Pa., to Baychester, N. Y., for use in connection with a new highway bridge over the six-track Hell Gate Bridge route of the New York, New Haven & Hartford at that point

EDITORIALS

Don't Expect What You Fail To Ask For

For at least the best part of the last ten years railroad repair shop supervisors and mechanical officers have been reminded frequently that advances in machine tool design have made obsolete a large part of the equipment of this character in railroad shops. The evidence of this obsolescence becomes obvious almost every time a modern machine was installed in a shop and direct comparisons were made on a production output or cost basis with machines of from 10 to 30 or 40 years old. Because of the fact that very few railroads have carried out any regular program of shop equipment replacement the average age of shop machine tools in locomotive repair shops has been steadily rising.

The development of high-speed and tungsten-carbide cutting tools paralleled the progress that has been made in machine tool design and the modern machines were largely built around the fact that these tougher tool steels were able to stand up under so much heavier cuts that greater machine-tool rigidity, increased motor horsepower and finer workmanship to produce previously unheard-of accuracy were absolute necessities in order to gain the production of which the cutting tools were capable.

It wasn't long before the machine foremen and tool supervisors in locomotive shops became conscious of the fact that the newer high-speed steels—and even in some cases the new carbide tools—had qualities that gave a new lease of life to many of the older machine tools that met certain requirements as to condition. So, the result of the introduction of these new cutting tools into the field of locomotive part machining was that they were found to be indispensable in order to get any kind of output from the older machines, and to assure that the production from the new machine was of such character and volume as to warrant the investment that had been made in the new facilities.

Now comes trouble! Because practically all munitions and defense work in which machining is involved is a high-production job it was but natural that the Office of Production Management, familiarly known as O.P.M., should issue orders putting cutting tools under priority control. Previously orders had been issued by means of which control over such basic metals as chromium and tungsten could be exercised. The present order regulating the distribution of cutting tools defines such tools as special drills, reamers, milling cutters reamers, taps and die-head chasers, among others, as coming within the scope of the order and provides, in part, that "no manufacturer or distributor may accept or make delivery under an order for cutting tools which does not bear a preference rating of A-10 or higher. . . ."

The point of this discussion is that under such conditions as we are now faced with there are two types of railroad shop supervisors with respect to their attitude toward getting things such as special cutting tools; the man who says "What's the use, we can't get it anyway," and the man who says that he recently read in the papers that the railroads have some sort of a blanket rating that will get them anything they want, so he just doesn't make any noise about it at all.

Both of these men are wrong. To date only limited blanket ratings have been issued for specific purposes and on most repair shop facilities it is still necessary to exert the utmost effort to get individual preference ratings for what is needed. In this matter of cutting tools it is more important than ever before for the locomotive shops to get their share of the special tools for machining operations. If supervisors and officers fail to ask for what they need—and ask rather insistently—it's a sure bet that from now on they won't get it.

Locomotive Lubrication

Railroads cannot give too much attention to methods of determining desirable allowances of oil to locomotive valves, cylinders and steam auxiliaries, and the best method of operating locomotives to minimize damage commonly caused by drifting, particularly at high speeds and short cut-offs, with resultant drawing of air, front-end gases and cinders into valves and cylinders, carbonizing or flashing the oil and destroying lubrication.

Adequate lubrication of locomotives is essential for economical operation, and too little lubrication results in locomotive failures, increased maintenance costs and increased fuel consumption. However, increased use of oil beyond the point necessary for complete lubrication of the moving parts is wasteful and often results in damage due to excessive carbon deposits in valves and cylinders. Many roads instruct enginemen not to close the throttle entirely until a stop is made.

The setting of mechanical lubricators to deliver the correct amount of oil to each outlet requires care and experience. One method which has proved satisfactory in practice is as follows: By trial and observation on the road, feeds are adjusted to each delivery point until the minimum amount of oil necessary for satisfactory lubrication is being delivered. In this connection, it

must be realized that, other conditions being equal, increased average speed requires an increased amount of valve oil and increased average load requires an increased amount of valve oil.

After the lubricator feeds have been set to give satisfactory lubrication for one locomotive of each class, the lubricator is then removed from the locomotive, connected up on a test rack and operated at a speed corresponding to not higher than the average speed in the class of service in which the locomotive is used. The lubricator is operated for the number of revolutions equivalent to a 20-mile run, and the output of oil from each feed measured in a glass cup graduated in liquid ounces. This information is then used as a guide in setting lubricators on other locomotives of the same class. Another method for determining the amount of oil necessary from lubricators, both mechanical and hydrostatic, involves the use of a formula, taking into account the area of frictional surface, boiler pressure, degree of superheat, number of piston strokes and speed.

Dependable force-feed or automatic lubrication of machinery is one of the most important factors in long locomotive runs and intensive utilization of motive power. The availability of the conventional-bearing locomotive is greatly increased by automatic machinery lubrication, and much concentrated attention is now being given by mechanical supervisors to piping arrangements for force-feed lubrication of machinery for both roller-bearing and conventional-bearing locomotives, as well as various types and arrangements of oil dividers or splitters.

These and other important phases of the problem of reducing locomotive friction are being considered in a constructive report on lubrication to be presented at the Fall meeting of the Railway Fuel and Traveling Engineers' Association.

Safety Features in Streamliner Operation

With substantially higher operating speeds and the ever-urgent need for safety, it is perhaps not surprising to discover how much intensive engineering development and research work have been done in the last few years to develop various devices designed to surround the operation of modern streamline passenger trains with every possible safeguard.

One important feature has been the oscillating headlight which is sometimes used to throw a light beam in the form of a figure eight, visible in clear weather a quarter of a mile on either side of the track and serving as a warning to anyone on the highways near-by or crossing the railroad right-of-way. The conventional headlight throws a powerful beam straight ahead along the track and assures visibility for the engineman. Another safety innovation is the electric hot journal alarm which gives warning in the locomotive cab if a journal bearing on any axle of the train gets hot. The alarm also causes a red light to glow in the car on which the hot journal is located, thus facilitating quick location of the defective journal by members of the train crew while the signal in the cab causes the engineman to stop the train.

A safety derailment guide flange has been developed for application on power truck pedestals in such a way that, in case of derailment, the truck is guided along the track and prevented from turning to a sharp angle which would tend to throw the car out of alinement in the train and thus subject it to possibly greater damage. The electric control, which governs the degree of brake pressure in relation to train speed so that the application of air brakes will not cause the wheels to slide, is also definitely a safety feature. An automatic water spray has also been developed which sprinkles water on the wheels to keep them cool during braking application when descending long grades. A sanding device automatically sprays sand on the rails ahead of power truck wheels in emergency applications of the brakes and can also be operated by the engineman for any normal stop if necessary.

As regards the locomotive itself, in the case of steam power, the usual safeguards for reliable safe operation are well known and widely used. For trains hauled by the newer Diesel motive power, the "dead man" control is incorporated, requiring the engineman to keep a hand or foot constantly on the control lever, otherwise causing the train to come automatically to a stop. The inter-communicating telephone system, which enables the engineman to talk with the train crew in the rear of the train, and the long-distance siren and electric gong used in regular operation, may be considered safety features. Other devices, each vitally important in the performance of their special functions, include a control which automatically stops the engines if there is any failure in the lubricating oil pressure, and a thermostatic alarm on each engine which rings a bell in the affected unit whenever there is overheating.

Low Water — And Nothing Happened!

As long as steam locomotives have operated on the railroads of this country there has been one thing which train service men have feared above all others—boiler explosions, and the resultant deaths, injuries and damage to property. It is only natural, therefore, that those who over the years have been responsible for the design and operation of locomotives should constantly be working to develop ways and means of eliminating this dangerous type of railway accident.

About 11 years ago the Baltimore & Ohio built and initiated experiments with the first of the locomotive boilers having a water tube firebox designed by its present chief of motive power, George H. Emerson. Since that time this particular type of boiler has been applied

and is being used on 13 locomotives in service on that road. It is not the purpose here to describe that type of boiler—that was done in the August, 1931, issue of *Railway Mechanical Engineer*—but to mention, and comment upon an accident that recently took place which throws considerable light upon the value of the work that has been done on the B. & O. over this 11-year period in the field of locomotive steam boiler safety.

In the original conception of the Emerson water tube firebox it was believed by its designer that, should the boiler ever be subjected to a low water condition such as causes so many disastrous explosions, certain things would take place. The design was laid down with the idea that as the level of the water in the boiler receded—a condition which in the conventional design results in exposing the crown sheet to the high firebox temperatures—it would first uncover the top rows of small boiler tubes and that the collapse of some of these tubes or the fact that one or more of them might pull away from the tube sheet, would serve, like a bursted flue, to lower firebox temperatures and to act as a safety measure in preventing the collapse of the firebox.

At 2:25 a. m. on August 12 Baltimore & Ohio locomotive No. 5600, handling a 27-car train westbound, came to a stop about 57 miles east of Cumberland, Md., because the loss in steam pressure had so far cut down the speed of the turbo-generator that reduced voltage caused the automatic train control to apply the brakes. No. 5600 is the 4-4-4-4 type locomotive that was exhibited at Atlantic City A. A. R. convention in 1937 and is one of the latest locomotives with the Emerson water tube firebox. Prior to the actual stoppage of the train the engine crew had been conscious of a steam blow which the fireman had reported to the engineman was in the firebox. In fact when the steam pressure first began to drop the steam leaking into the firebox was sufficient to blow steam and gases out into the cab when the throttle was eased off and the firedoor opened.

During the investigation of what subsequently happened the engineman stated that at no time prior to the point of the final stop did he call for a second injector to be used. This is mentioned as an indication that the engine crew had no idea that a serious low-water condition existed. Yet, when the locomotive was hauled dead to the enginehouse and an inspection made of the boiler it was found that there was definite evidence that the water level had reached a low point of 28⅜ inches below the bottom gage cock. Several small tubes and one large superheater flue had collapsed and several tubes and flues had pulled away from the flue sheet. The rear flue sheet was bulged 1 inch on the right side and ½ inch on the left side taking in an area of 41 tubes and 8 flues on each side. Not only was the bottom of the top drum exposed to the fire but the low water point was 11 inches below the bottom of the drum. Yet, the violent circulation of the water in the water tubes at the firebox sides was sufficient to protect this drum, and the top headers, from serious damage.

The above circumstances speak for themselves. The estimated expense for repairs is $350.

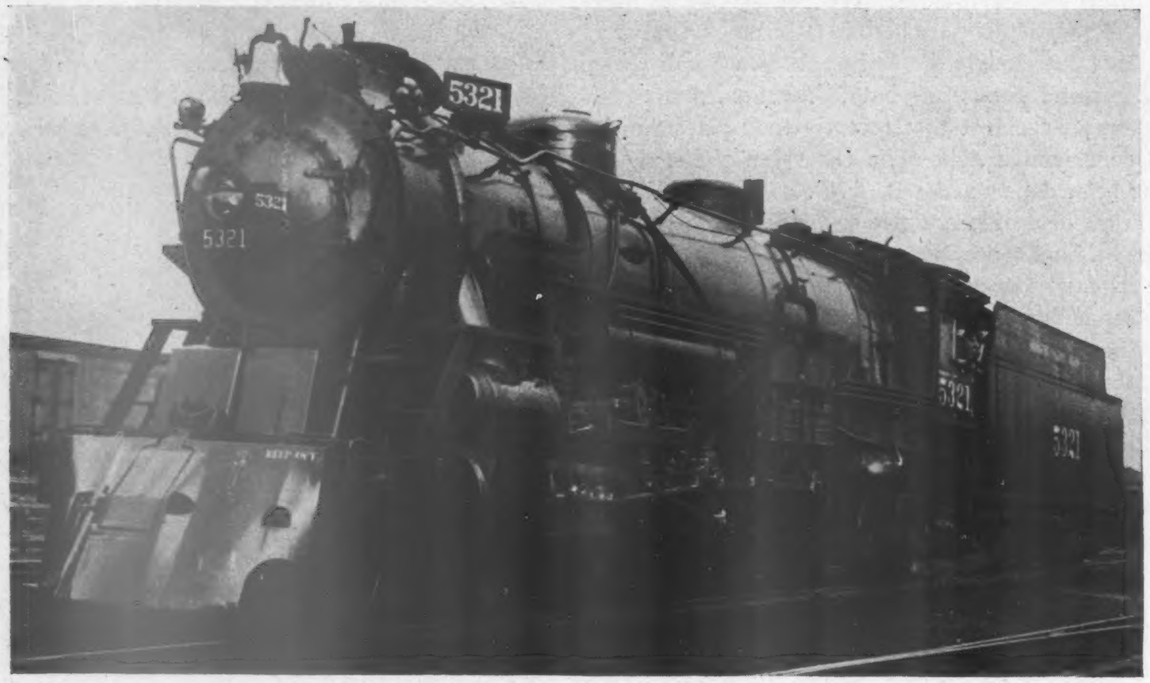
New Books

DIESEL ENGINEERING HANDBOOK. *1941 de Luxe Edition. Published by Diesel Publications, Inc., 192 Lexington Avenue, New York. Leatherette Cover. 521 pages. Price, $5.*

This book is another edition, in this case identified as Volume II, of a handbook for the practical Diesel engine maintenance man and operator which first appeared in 1935. Volume I under its present title appeared late in 1939 as the 1939-40 Edition. This was reviewed in the March 1940 issue of *Railway Mechanical Engineer* and dealt principally with the fundamentals of Diesel engine design and operation. Its chapters described in detail the various engine parts and accessories. Volume II is a supplementary work in which material is used that has not appeared in prior editions of this handbook. The first half of the book deals with Diesel engine economics, engine selection, power-plant building, supercharging, heat exchangers and exhaust systems. Three chapters are included on lubrication, fuel oil and injections systems and the remainder of the book discusses maintenance and drive systems. Included in this part of the book, is a chapter on Diesel-electric locomotive drives in which circuit diagrams are used to show the typical locomotive drive system.

PROCEEDINGS OF THE RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION. *Published by the Association—T. Duff Smith, secretary, 327 S. La Salle Street, Chicago. 339 pages. Price, $3.*

The committee reports presented at the fourth annual meeting of the Railway Fuel and Traveling Engineers' Association held at Chicago in October, 1940, and included in the Proceedings cover Air Brakes; Coal Preparation—Mechanical Cleaning; Fuel Records and Statistics; Locomotive Firing Practice (both coal and oil); New Locomotive Economy Devices; Stationary Boiler Plants; Turbine and Condensing Locomotives, and Utilization of Motive Power. Other special papers, also presented at the meeting and included in the Proceedings, were on the Proportions of Steam Generated in Locomotive Boilers Used for Other Purposes, by E. E. Chapman, mechanical assistant, Atchison, Topeka & Santa Fe; Tests Conducted by the New York Central at Selkirk, by W. F. Collins, engineer tests, New York Central; The Road Foreman and the Diesel Locomotive, by L. W. Powell, road foreman of engines, Atchison, Topeka & Santa Fe; How Much Locomotive Fuel Can Be Saved?, by J. G. Crawford, fuel engineer, Chicago, Burlington & Quincy; Fuel Economy from the Viewpoint of the Chief Dispatcher, by T. O. Weeks, chief dispatcher-division trainmaster, Missouri Pacific. There was also included in this publication several charts and photographs taken from a motion picture made at the test plant of the New York Central at Selkirk, N. Y. showing what takes place in a locomotive firebox at high firing rates.



A 4-8-2 type locomotive rebuilt in Missouri Pacific shops

Missouri Pacific

Rebuilds Locomotives

Converts seven U. S. R. A. light 4-8-2's to modern design and ten 2-8-4's to high-speed 4-8-4's in the past two years at Sedalia shops—New shop machinery played important part in keeping costs down

SINCE the summer of 1939, the Missouri Pacific has been engaged in an extensive program of rebuilding and modernizing motive power at its main locomotive shops, Sedalia, Mo., which has already effected important savings and improvements in steam locomotive performance on this railroad. Up to date, seven U. S. R. A. light Mountain-type passenger locomotives, built by the American Locomotive Company in 1919, have been converted to efficient modern high-speed locomotives with the same wheel arrangement, the original Missouri Pacific Nos. 5301-07, incl., having been changed to Nos. 5321-27, incl. This job consisted of applying almost entirely new and longer locomotive boilers, renewing the slab frames with provision for increased wheel spacing, application of new and larger driving wheels, roller bearings throughout, new valve gear and rods, and converting from coal- to oil-burning.

During the same period, ten 2-8-4 type locomotives, built by the Lima Locomotive Works in 1930, were converted into modern high-wheel 4-8-4 type units, adaptable to heavy fast service, either passenger or freight. These locomotives, originally Nos. 1901-10, incl., are now designated Nos. 2101-10, incl., and there are 15 more of the same class scheduled to be rebuilt. In this conversion job also, practically complete new boilers were constructed at the Sedalia shops, new cast steel bed frames with integral cylinders applied, also new and larger driving wheels, roller bearings, new valve gear and rods, and larger tenders installed.

Since being placed in service, the reconstructed locomotives of both classes have given an excellent performance from the point of view of reliability, high monthly mileage and the satisfactory handling of modern highspeed trains in both passenger and freight service without introducing excessive stress in either the track or equipment. A notable increase in locomotive availability and mileage have been secured. For example, during the month of June, 1941, seven locomotives of the No. 5321 class made a total of 104,530 miles in passenger service, or an average of 14,930 miles per locomotive. This may be compared with an average of 4,790 miles per locomotive per month prior to the conversion and reconstruction work, which means that the monthly mileage has been increased over three times. Similarly, with the No. 2101 class, seven locomotives accumulated 75,288 miles during the month of June, or 10,755 miles per locomotive in freight service, which may be compared with an average of 4,115 miles per

A 2-8-4 type locomotive rebuilt and modernized at Sedalia shops as a high-speed 4-8-4 type

locomotive per month previous to the conversion, this ratio of improvement being 2.61 to 1.

Changes in Principal Locomotive Dimensions

Referring to one of the tables, the comparative dimensions of these two classes of Missouri Pacific locomotives, before and after conversion, are given. In the case of the No. 5321 class, the cylinder diameter has been reduced ½ in.; driving wheel diameter increased 6 in.; total engine weight increased 34,900 lb.; boiler tubes lengthened 1½ ft., tube and flue, also superheater heating surfaces increased slightly; boiler pressure increased 25 lb.; and the tender equipped with a 5,650-gal. fuel oil tank.

The increase in driving wheel diameter from 69 in. to 75 in. for the new Baldwin disc-type wheels was made possible by the application of new slab frames which increased the rigid wheel base from 18 ft. 3 in. to 19 ft. 6 in. A General Steel Castings four-wheel engine truck and two-wheel trailing truck were installed, the wheel size of the former being increased from 33 in. to 36 in., and the latter from 43 in. to 47 in. Timken roller bearings were applied on all locomotive wheels, with A. S. F. roller-bearing units on the six-wheel tender trucks.

A practically complete new boiler was constructed and applied to the existing back end, the length over the flue section being increased 1 ft. 6 in. and the smoke box 2½ in. The firebox construction was strengthened to accommodate the increased boiler pressure and the Type A superheater units were converted into Type H. A. units. The stoker was removed and stored, since the new locomotive was equipped for oil burning.

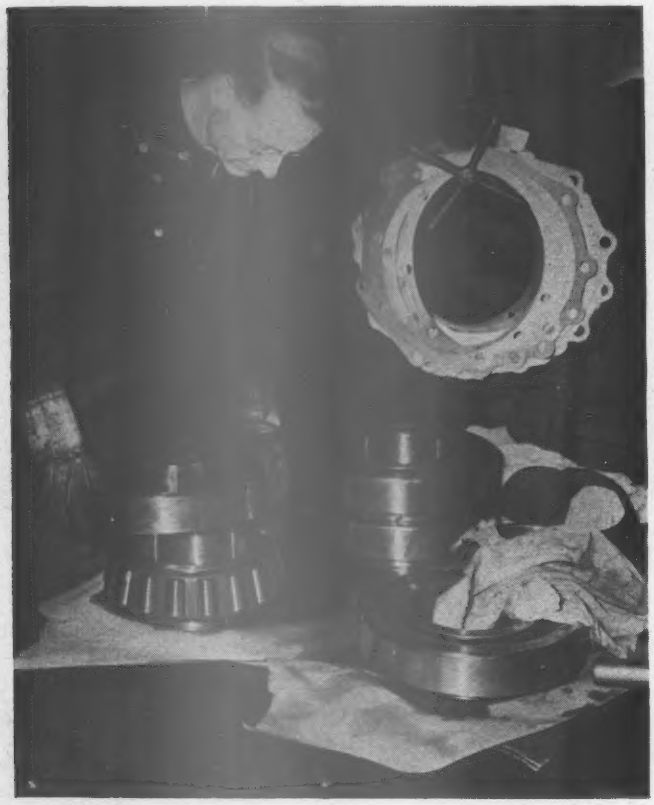
The cylinders were rebushed to reduce the diameter ½ in. and new valve-chamber bushings applied, also L. F. M. lightweight steel pistons in combination with Universal sectional packing. A fire pan and brick arrangement was applied in accordance with the standard Missouri Pacific oil-burning arrangement. The right injector was replaced by a Sellers Type SR injector with Edna top boiler check. The Worthington feedwater heater was rebuilt and modernized.

New rods were made at Sedalia shops and applied, also bar-type guides, forged crossheads, and Walschaert valve gears, the latter being equipped with needle-type roller bearings. All reciprocating and revolving parts were accurately weighed and the driving wheels counterbalanced, the main wheels being cross-balanced. A new streamline pilot with retractible coupler was applied. The lagging was extended to include the smokebox and a Wellsville polished steel jacket applied on the boiler and smokebox.

Conversion of the No. 1900 to No. 2100 Class Locomotives

In the case of the No. 1900 to No. 2100 conversion, again referring to the table of comparative dimensions, the driving wheel diameter was increased 12 in.; total

Missouri Pacific 4-8-4 locomotive bed with integral cylinders and reservoir made by the General Steel Castings Corporation



Inspecting one of the Timken engine-truck roller bearings

Comparative Dimensions of Two Missouri Pacific Locomotives Before and After Conversion

	Original No. 5301 4-8-2	Rebuilt No. 5321 4-8-2	Original No. 1901 2-8-4	Rebuilt No. 2101 4-8-4
Built by	Alco.	Mo. Pac.	Lima	Mo. Pac.
Date	1919	1939	1930	1940
Cylinder size, in.	27 by 30	26½ by 30	28 by 30	28 by 30
Valve diameter, in.	14	14	14	14
Type of valve gear	Baker	Walsch.	Walsch.	Walsch.
Stoker	B. K.	None	B. K.	B. K.
Booster	None	None	None	None
Feedwater heater	4-S	4-S2	4¼ B. L.	4¼ B. L.-2
Driving wheel diameter, in.	69	75	63	75
Loaded weights, lb.:				
Drivers	227,400	244,380	275,500	279,360
Trailer	54,000	55,720	96,900	96,590
Engine truck	53,800	70,000	39,800	70,000
Total engine	335,200	370,100	412,200	445,950
Boiler tubes:				
Number	40-216	40-213	77-204	50-190
Diameter, in.	5½-2¼	5½-2¼	2¼-3½	2¼-3½
Length, ft.	20½	22	21½	21½
Heating surface, sq. ft.:				
Firebox	323.5	323.5	256	355.7
Tubes	2,598	2,747	969.4	630
Flues	1,176	1,261	3,999	3,725
Arch tubes	14	..	15.5	15.5
Syphons	77	77	85	111
Total	4,189	4,409	5,325	4,837
Superheating surface, sq. ft.:	966	1,084	2,330	1,953
Ratio of adhesion	4.22	4.55	4.14	4.19
Steam pressure, lb.	200	225	230	250
Tractive force, lb.	53,900	53,720	66,500	66,640
Tender capacity:				
Coal, tons	18	..	20	20
Oil, gal.	..	5,650	..	..
Water, gal	15,000	15,000	17,250	17,250

engine weight increased 33,750 lb.; firebox heating surface substantially increased by the addition of a 63-in. combustion chamber equipped with a Thermic syphon; and the steam pressure increased to 250 lb. per sq. in.

In rebuilding the boiler of this class of locomotive, new second and third-course barrel sheets were applied, using the original smokebox and first course applied to the original back end of the boiler with a new extension on the wrapper sheet to take the new circumferential seam at the back of the third course. The original boiler dome was re-applied.

Axle lathe on which accurate fits, gaged with micrometer calipers, are made

Assembling the Edna lubricator drive on the right side of one of the locomotives

The firebox was renewed, including a 63-in. combustion chamber, using the original mud ring, with a new outside throat sheet and braces. Nicholson thermic syphons were applied, including one in the combustion chamber. Duplex Thermic syphons were installed for test purposes in one locomotive only.

The superheater header was re-used together with the original Type E units. Owing to the application of the combustion chamber, however, four holes, right and left in the header, were plugged. Five double units were omitted at the bottom of the unit assembly and instead three single units were applied. The original length over the flue sheets was maintained, and the original smokebox arrangement, with a 22-in. stack, was not changed. The Type BK stoker was repaired.

A General Steel Castings bed frame, having integral cylinders and main reservoir, was applied. New cylinder bushings were installed, together with L. F. M. pistons in combination with Universal sectional bull rings and packing rings. The new 75-in. Boxpok driving wheels were mounted on new axles in Timken roller-bearing box assemblies, Franklin compensators and snubbers being applied to take up wear or slack on all driving boxes. The Alco lateral cushioning device was installed on the front drivers. A new General Steel Castings four-wheel engine truck was equipped with Timken roller bearings and 36-in. wheels. The four-wheel trailing truck was not changed, but Timken roller bearings were applied to new axles in the original 33-in. and 45-in. wheels. A lateral motion device was also incorporated in this truck design.

New main and side rods were installed and the original Walschaert valve gears replaced by new Walschaert gears, equipped with needle-type roller bearings. Multiple bearing guides and crossheads were applied, the guides incorporating Alco expansion clamps and the crossheads Baldwin-type pins and keys. The Worthington Type 4¼ BL feedwater heater was rebuilt into a Type 4¼ BL-2 by applying various wing-type valve service, steam cylinder and valve gear parts. An Edna 824 lubricator was applied to a bracket located on the back of the right steam chest cover with drive-arm connection to a bracket on top of the link cheek. A similar lubricator was applied on the left side back of the link support, drive being taken from the top of the link cheek. The original power reverse gear was re-applied. The lagging was extended to cover the smokebox, a Wellsville polished sheet jacket being installed complete over the back head in the cab, boiler proper, jacket bands, smokebox, sides of cylinders, steam chests and steam pipe casings.

The original 17,250-gal. tender was used and roller bearings were applied to the six-wheel trucks, which have 33-in. wheels. A Franklin Type E-2 radial buffer was applied between the locomotive and the tender, with a pocket welded to the front of the tender frame. The tender was piped for steam heat and air signals so that these locomotives may be used for passenger service, if desired. The original brakeman's cupola was maintained. Water-car piping was also maintained, but relocated to suit the steam-heat pipes.

How the Work Was Handled in the Shop

From a production standpoint, this conversion work was scheduled through the Sedalia locomotive shops along with other classified repair jobs, dates being assigned for the completion of various units of work in accordance with the boiler test date. Double-shift operation was used wherever necessary, primarily on motion work and in the wheel shop. Boiler sheets were laid out and stack-cut four at a time for the first four locomotives and subsequently three at a time. The application of roller bearings necessitated greater accuracy in both wheel and axle work and also in the lining of shoes and wedges and fitting driving boxes to the frame pedes-

Man-Hours Used on Various Units of Work in Rebuilding M. P. 1901-Class Into 2101-Class Locomotives*

Unit of work	Average man-hours
Dismantling man-hours	952
Boiler first course, complete	304
Boiler second course, complete	547
Boiler third course, complete	752
Fire box made, complete	462
Fire box applied, complete	2,382
Staybolt bushings, complete	227
Outside throat sheet, complete	458
Boiler braces, blacksmith shop complete	90
Back end fit up and applied complete	476
Syphon applied, complete	153

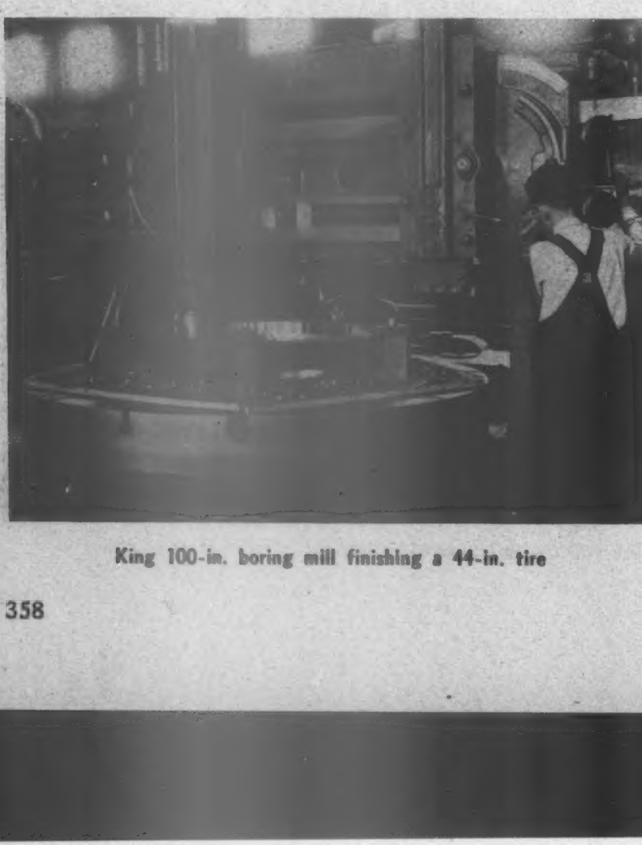
* Figures shown are the average for the first four locomotives rebuilt.

Norton grinder finishing a roller-bearing axle

Unit of work	Average man-hours
Smoke box repaired, complete	160
Flues manufactured, complete	95
Flues applied, complete	133
Ash pan and grates repaired and applied, complete	293
Tank repaired, complete	645
Front end appliances, complete	103
Front flue sheet, made and applied	279
Running boards, made and applied	308
Foam meter box, made and applied	46
Turret casing, made and applied	59
Furnace bearer oil casings, made and applied	51
Cylinder jackets, made and applied	82
Sand dome remodeled	105
Steam pipe casings made and applied	18
Miscellaneous boiler work	240
Engine cab, complete	285
Brakeman cab, complete	8
Shoes and wedges, machined	132
Layout work	96
Link supports, machined	95
Furnace bearer shoes, machined	74
Spring rigging, forged	522
Spring rigging, machined	80
Brake rigging, forged	166
Brake rigging, machined	128
Steam and dry pipe, machined	32
Feedwater pump, machine work	14
Lateral device, machine work	7
Front cylinder heads, machined	26
Miscellaneous bolts, machined	184
Miscellaneous studs, machined	151
Cylinder bushings, machined	23
Valve bushings, machined	28
Guide clamps and guides, machined	19
Miscellaneous sawing and threading	106
Miscellaneous, machine work	131
Side and main rods, forged complete	171
Side and main rods, machined complete	653
Driver wheels complete ready to apply	808
Motion work complete, forged complete	241
Motion work complete, machined complete	888
Trailer trucks complete, ready to apply	190
Engine truck complete, ready to apply	168
Tender trucks complete, ready to apply	644
Pilot complete, applied	167
Radial buffer complete, applied	25
Mill and upholstery work	74
Blacksmith, miscellaneous	248
Jacket made and applied	535
Lagging applied	86
Piping complete	1,708
Units repaired	77
Stoker, repaired and applied	98
Water pump, repaired	52
Brass room work, complete	103
Air room work, complete	190
Locomotive carpenter, engine desk	14
Electrical work, complete	51
Erecting cab gang, all boiler mounting work	1,082
Erecting floor, complete	1,379
Paint, complete	139
Steam and dry pipes and units, applied	350
Total man-hours (including dismantling)	21,868

Division of the Work Between Major Departments

Dismantling	952
Boiler shop	8,761
Machine shop	4,691
Blacksmith shop	2,006
Erecting shop	2,811
Piping complete	1,708
Other work	939
Total	21,868



King 100-in. boring mill finishing a 44-in. tire

Niles quartering machine finish-rolling a crank pin in a pair of driving wheels equipped with Timken roller bearings

tal ways. Approximately 800 man-hours a day were expended on the conversion work which consisted of a large number of unit operations, as indicated in one of the tables. This table shows the average number of man-hours per job required in converting the first four No. 2101 class locomotives. A summation of these figures for the major shop department shows the following: Dismantling, 952 man-hours; boiler work, 8,761 man-hours; machine shop work, 4,691 man-hours; blacksmith shop work, 2,006 man-hours; erecting shop work, 2,811 man-hours; pipe and other work, 2,647 man-hours; total, 21,868 man-hours per locomotive.

Another table lists new machinery installed at Sedalia shops during the past two years which has proved quite helpful for the conversion work as well as for general repair operations. An examination of this table shows that the equipment includes, in addition to modern boring, turning and grinding machines, one electric welding unit, three Magnaflux inspection units and a considerable amount of crane equipment which indicates the importance of ample capacity for lifting and moving heavy material in work of this kind. The most important item of this equipment was the Whiting 25-ton crane, installed for handling boilers over the Bull riveter in the boiler shop. This 125-ton riveter has a horn 12-ft. high and, in order to handle the longer and heavier boilers while fitting the courses and driving rivets in

Principal New Tools and Equipment Recently Installed at the Sedalia Locomotive Shops of the Missouri Pacific

Size	Type of Machine
100-in.	King heavy-duty vertical boring and turning
16-in. by 40-in. by 120-in.	Norton piston-rod grinder, Type C
8-in. by 28-in.	Sundstrand automatic lathe, Type B
24-in.	Cincinnati crank shaper, heavy rapid traverse
4-ft.	Fosdick radial drill (15-in. column)
24-in. by 6-ft.	Lehmann engine lathe (swings 27 in. over ways)
No. 2	Norton universal tool and cutter grinder
¼-in. to 3-in.	Oliver twist-drill grinder and pointer
½-in. to 3-in.	Oliver twist-drill point thinning machine
16-in.	De Walt wet metal-cutting, Type GLUY
36-in.	Continental Doall contour shaping machine
½-in. to 6-in.	Mathews-Ryerson tube cutting
	Yates-American double-spindle shaper, Type N-44
	Greenlee double-spindle shaper, No. 180-B
	Ideal portable electric welding unit
	Three Magnaflux inspection units, Type ER-3
25-ton, 24-ft. span	Whiting single-motor overhead traveling crane
2-ton	Stupp Bros. jib crane (18-ft. radius)
4,000-lb.	Sprague electric hoist (floor operated)
3,000-lb.	Ingersoll-Rand pneumatic hoist with top hook
1½-ton, 16-ft. span	Conco single I-beam hand-geared crane

Locomotive driving rods are forged, heat-treated and machined at the Sedalia locomotive shops

the machine, it was necessary to install a more powerful electric crane and strengthen the crane-supporting structure. The resultant great improvement in quality and reduction in cost of fabricating the boilers more than justified the expense.

The largest machine tool installed was the King 100-in. mill, used for all large boring and turning operations. When turning tires, a cutting speed of 200 ft. per min. and a feed of .0315 in. per revolution are used, with cutting-tool tips of Firthite tantalum-carbide. These tips, $7/16$-in. by $3/8$-in. by 1 in. long, are sweated into the tool holders; the cutting edges are kept smooth and sharp; and a small chip-breaker groove is ground just back of the edge. This tool finish bores about 24 tires per grind and has a service life of about three months.

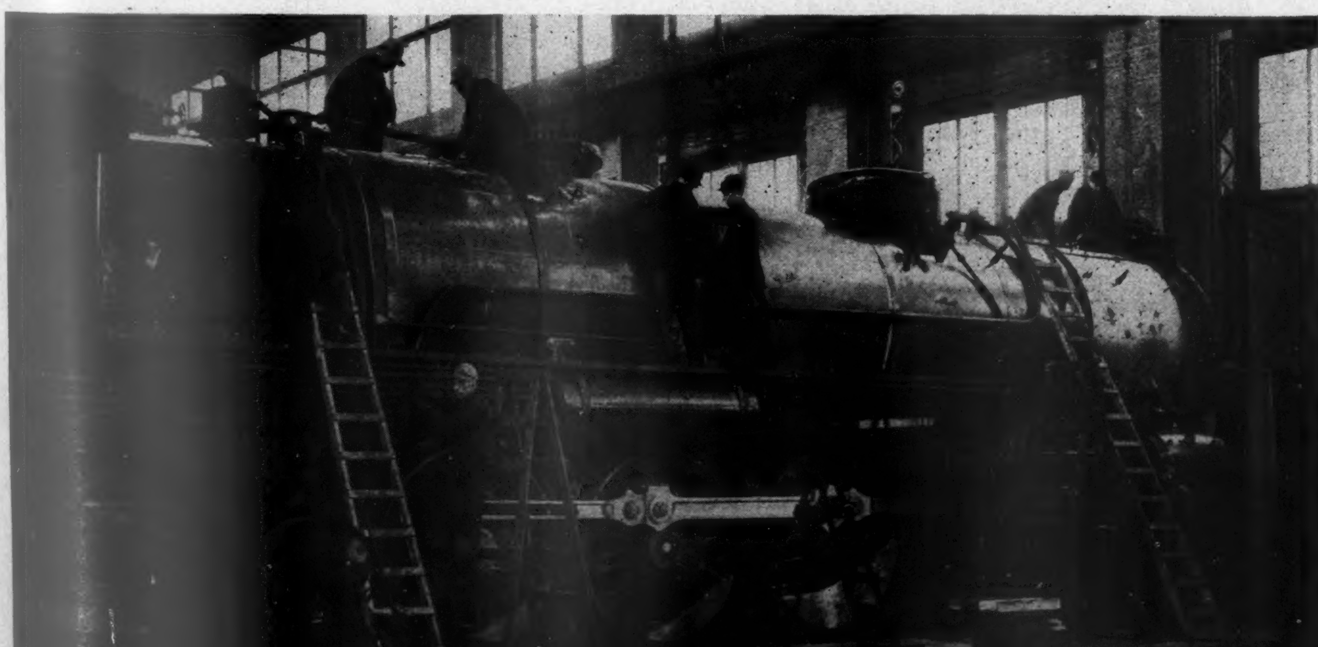
Driving and trailer tires were formerly purchased by the Missouri Pacific at an extra cost of $3/4$ cents per lb. for finishing. This work is now being done with the new boring mill for about $1/10$ cent per lb. Based on the number of new tires purchased annually for the system and which can now be machined at Sedalia shops, it is estimated that the new boring mill will effect a saving of approximately 28 per cent per year on the investment.

Another machine, especially important for the production finishing of locomotive axles, crank pins, piston rods, etc., is the Norton gap grinder which swings either 16-in. or 40-in. work, the distance between centers being 120 in. This machine replaces an old belt-driven grinder of antiquated design which was difficult to operate and secure the desired degree of accuracy and high output.

A feature of the new Norton grinder installation is the use of a floating foundation designed to insulate the machine effectively from all shop vibrations. The machine is bolted to a concrete base plate which rests on a 12-in. layer of sand, the sand being supported on and confined in a heavy concrete sub-base or foundation of box-type construction, built into the shop floor. It is estimated that this Norton grinder will save about 20 per cent per annum on its installation cost.

Similarly the new Cincinnati 24-in. crank shaper, used for shaping guide liners, crank-arm keys, wheel and axle keys, rod liners, rod brasses, frame keys and other miscellaneous small work replaces an older machine which was worn out, slow in operation, inadequate, obsolete in design and required frequent extensive repairs. This shaper, it is estimated, will save about 30 per cent per year on the investment.

The new Lehmann 24-in. engine lathe performs turning and boring operations in connection with repairs to air brakes, safety valves and injectors requiring extreme



One of the No. 5301 class locomotives in the Sedalia erecting shop

accuracy. The lathe formerly used for this work during the past 28 years was so badly worn that it could not be repaired and, even in its original condition, the machine could not be compared with a modern engine lathe from the point of view either of accuracy or productive capacity. The new engine lathe is estimated to save

Front and back flue sheets for one of the new locomotive boilers

about 33 per cent of its total cost, installed, on boring and turning operations in the air brake room alone.

The Fosdick 4-ft. radial drill is used in drilling forgings manufactured in the blacksmith shop on store orders, eliminating the necessity of hauling such forgings to the machine shop for drilling. This work was formerly done on vertical drill presses built in 1905 and 1910. Both of these machines were old, slow in operation and not designed for the heavy drilling now being done in the blacksmith shop and were worn out to such an extent that they could not be economically repaired. It is expected that the new radial drill will save not far from 20 per cent of its total cost annually.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Expansion Needed For Welding Frames

Q.—Please state the amount of expansion needed for welding locomotive frames by the acetylene process.

A.—Although the amount of expansion varies with the location of the break and the pressure required to spread the frame, ¼ in. is usually sufficient for frames up to 6 in. square. Naturally, on smaller frames and on frames where the expansion is gained with little difficulty, $\frac{3}{16}$ in. or $\frac{7}{32}$ in. will suffice. Care must be exercised in relieving the expansion on a frame too soon after the completion of the weld, for if the weld is still too hot, the compression will upset the weld, thus causing the frame to be too short.

Cracked Driving Wheel Rims

Q.—We are having an epidemic of cracked driving-wheel rims. Is there some method of welding these breaks successfully?

A.—An accepted method of repairing broken driving-wheel rims is as follows: If the wheel is under the locomotive, turn it until the crack is at the bottom in an accessible position. Vee the break out with a cutting torch leaving about $\frac{3}{16}$ in. between the bottom of the V and the tire. The cut should be chipped or in some manner cleansed of all oxide. The break is then welded with a good grade of heavy coated rod and each layer thoroughly peened with an air hammer and bobbing pin. The weld should be reinforced slightly.

What To Do About Broken Binder Bolts

Q.—Frequently when applying the binders to the frame of a locomotive we break off a binder bolt. Sometimes this broken bolt is so located that it can easily be removed. On the other hand it may be one with counterbored head that requires the removal of the spring before it can be replaced. Have you any suggestions?

A.—Naturally, these bolts should be checked before the locomotive is wheeled. However, if this does happen, burn the broken bolt off an inch or so from the frame and weld on a new piece of bolt of the proper length. If this is done with the torch by an experienced operator, it will serve as well as a new bolt.

How To Repair Shop Steam Piping

Q.—In the last few years the ancient 6-in. steam piping in our shop has started to leak where the flanges are screwed onto the pipe. We have brazed the joints several times but this seems only a temporary repair for the joints start to leak again. Replacing this pipe would entail considerable expense. Is there some way of avoiding this expense?

A.—The best way of repairing leaky cast-iron flanges is to remove them entirely. Cut a 12-in. length of heavy pipe the same size as that in your steam line. The flange is now removed with a cutting torch. Do not attempt to cut to size when removing the flange, for if the steam line is hot, it will shrink or contract and leave too large an opening to be filled in with weld metal. As the contraction on all steam lines varies it is best to cut the new piece to length after the line has cooled. After the ends are trimmed, remove the slag and oxide and tack the new section in place. Then weld the new piece in place. This method eliminates a long shut-down of the steam needed for heat, etc., during the winter months.

Avoiding Fractures When Cooling

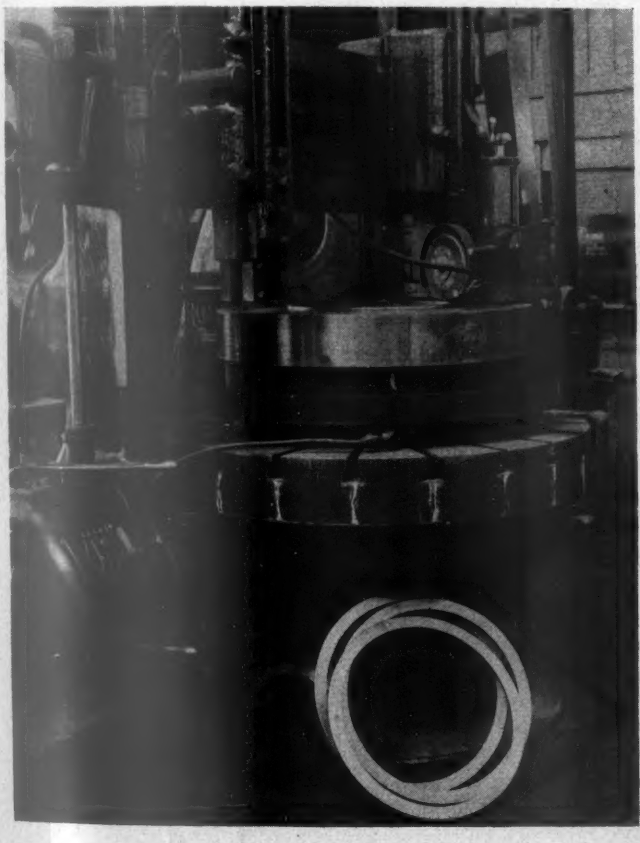
Q.—When making an electric weld the first bead often fractures as soon as it cools. How can this be avoided?

A.—This is a common happening, especially where there is no provision made for contraction. If it is impossible to preheat to overcome this cracking the only other solution is to make the first bead as heavy as possible. By laying a very heavy first bead it is possible to create strength enough in the weld to counteract

the stress and hold without fracture until successive layers of weld metal have built up the strength of the weld until there is no danger of cracking. Peening often helps to relieve some of the internal stress in a weld.

Three Interesting Grinding Jobs

Two of the three grinding jobs illustrated are due to the use of roller bearings on locomotive main drivers and the third to the use of a Franklin radial buffer between the locomotive and tender. In one it will be noted that a Timken roller-bearing housing is set up on the table of a Gray planer which has been adapted for grinding the shoe and wedge faces. The hardened spring steel liners wear about 0.016 in. before having to be trued and, without the grinding wheel, it would be difficult to machine this surface and not remove too much stock. The self-contained electric grinder rigidly secured to one of the tool posts and kept accurately true removes just enough stock to true up the pedestal ways to an accuracy of between 0.0005 and 0.001 in. The five-horsepower electric motor operates at 1,140 r. p. m. The grinding wheel is 24 in. in diameter by 2 in. wide.



A 50-in. boring machine equipped with magnetic chuck and V-belt operated grinding wheel for finishing spacer rings to the required thickness

Referring to another illustration, it will be noted that a magnetic chuck is used on a Gisholt 50-in. boring mill, the tool post being equipped with a patented electric motor-driven wheel with V-belt drive. The type of spacer ring used with Timken roller bearing housings is shown at the base of the machine and by means of the magnetic chuck and accurate grinding wheel, it is possible to produce spacer rings of the desired thickness with minimum loss of time and within the desired limits of accuracy. The rings in a semi-finished state are 21-in. in outside diameter by 18-in. in inside diameter by 3/8 in. thick. The first operation is to reduce the thickness to within 0.005 in. of size with a cutting tool. The ring is then ground to finish size for thickness, with an accuracy of 0.00025 in. As held in the magnetic chuck, two stops or dowels are required to keep the ring from turning while a cutting tool is used, but during the grinding operation the use of stops or dowels is not essential.

A vertical wheel surface grinder equipped with jig for truing Franklin radial-buffer chaffing plates

The third illustration shows an ingenious arrangement of radial grinding attachment for a Diamond vertical sur-

A planer adapted for grinding the shoe and wedge faces of Timken roller-bearing housings

face grinder. This attachment consists of a substantial welded bracket capable of horizontal movement on a lubricated base plate attached to the bed of the grinder. The upper bracket is bolted to a radius arm which is adjustable in length to suit the diameter of the Franklin radial buffer or chafing plate. By means of suitable set screws, the chafing plate is secured in a vertical position to the face of the bracket and reciprocating movement of the grinder table moves the chafing plate back and forth past the grinding wheel in such a way as to true the cylindrical surface of the buffer casting and bring it back to the desired radius. A buffer casting is shown at left of the jig.

Boiler Patch Applied to Circumferential Seam*

The design and application of boiler patches creates many interesting problems for the reason that the defects in no two boilers are exactly alike. Boiler shell cracks are of rather common occurrence and are usually repaired by the application of a diamond patch on the outside of the shell. Such cracks invariably occur near seams, waist-sheet angle irons, or other construction which complicates the design of the reinforcement.

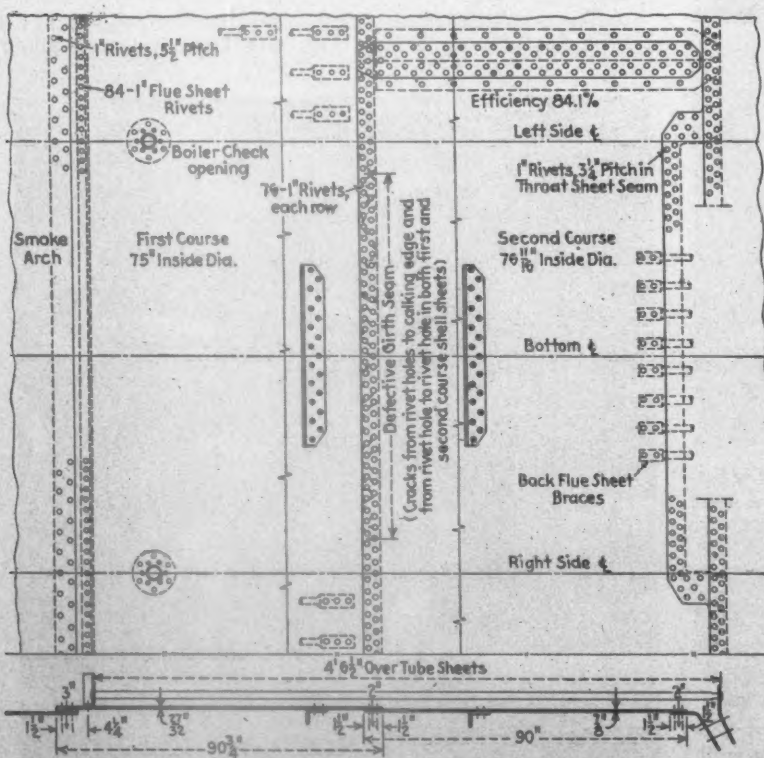
Several years ago an interesting and rather unusual case of boiler shell patching was experienced on the boilers of several Consolidation-type locomotives. The defects consisted of cracks in the circumferential seam between the first and second boiler courses, extending in some cases over practically half the circumference of the boiler. These boiler shells consisted of only two courses and the defects existed in both first and second course sheets. With the exception of the cracks in the girth seam, the boiler shells were in good condition.

The location and extent of the defects found in the boiler are shown as Fig. 1 of the attached sketch. Because of the length of the courses and the position of the longitudinal seams, neither the application of a new bottom to both the first and second courses nor the usual type of patch for minor defects in circumferential seams was desirable. It was decided to cut out the defective part of both first and second courses as shown in Fig. 2. Repairs were made by applying a new section of the second course, extending from the longitudinal seam around to the opposite center line, the section being butted up against the original shell. The new shell section was made sufficiently wide to extend over the first course where the original circumferential seam was duplicated. The connection between the old and new parts of the second course was made by means of a circumferential cover plate which also duplicated the circumferential seam. This cover plate was scarfed under the butt strap of the second course longitudinal seam, no change being made in the efficiency of this seam. This construction required considerable riveting, but made unnecessary any offsetting of sheets.

Both the new shell section and cover plate were stopped off by means of short diagonal seams, the plate efficiency of which was kept equal to or greater than the longitudinal seam efficiency. A sufficient number of rivets were used so that the shearing stress on rivets in the longitudinal seams was not exceeded. Rivet holes adjacent to the patch were used where necessary rather than new holes, and no changes were made in the stresses originally reported for this boiler.

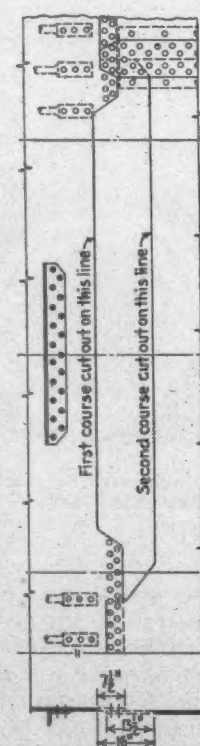
In patching boilers, the cause of the defect should be considered in order that, if possible, future trouble of the same nature will not be encountered after the boiler is repaired. In this boiler, the defects were considered

* An entry in the prize competition on boiler patches announced in the March, 1939, issue. The names of the prize winners were published in the August, 1939, issue.



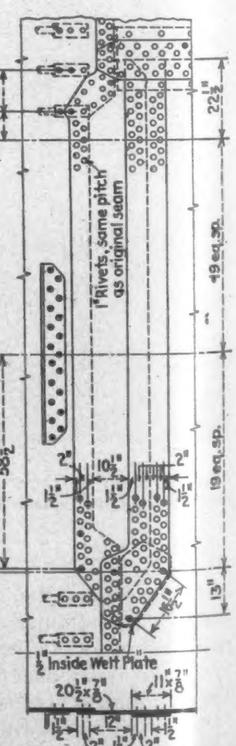
Development of boiler shell showing location and extent of defects in circumferential seam

Fig. 1



Defective portion cut out

Fig. 2



Replacement of defective circumferential seam

Fig. 3

to be caused by a water condition that had formerly existed, but which had been changed. To date no difficulty has been experienced with this boiler or others repaired in a similar manner.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Efficiency of Diagonal Row of Rivets

Q.—How is the efficiency of the diagonal row of rivets on a saw-tooth longitudinal riveted seam computed?—F. E. D.

A.—Fig. 1 illustrates a unit section of a typical saw-tooth longitudinal riveted seam. To obtain the efficiency along the diagonal row of rivets, the first step is to determine the angle that the diagonal row of rivets makes with either the longitudinal or the circumferential seams, as angles X and Y in Fig. 1. In this example the angle that the diagonal row of rivets makes with the circumferential seam (angle Y) will be considered for determining the efficiency.

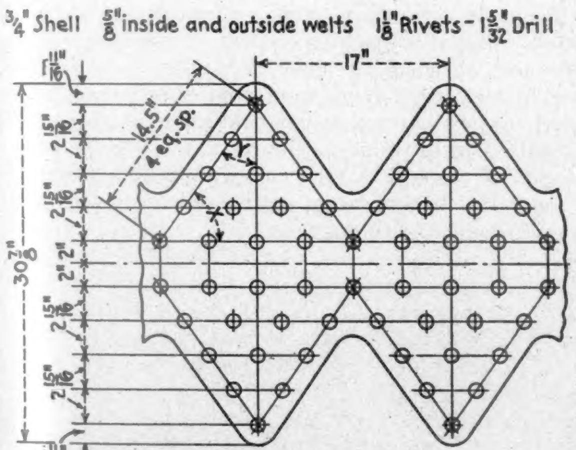


Fig. 1—Angles made by a diagonal row of rivets with the longitudinal and circumferential seams

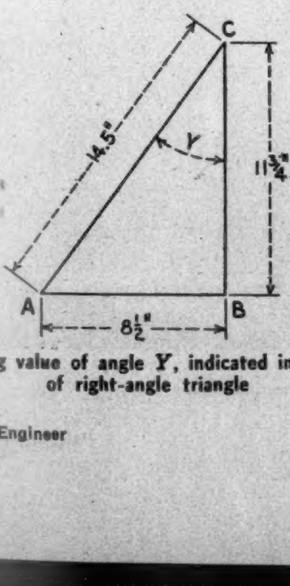


Fig. 2—Determining value of angle Y, indicated in Fig. 1, by solution of right-angle triangle

Table I—Factors for Determining the Strength of Diagonal Seams and Patches on Locomotive Boilers

					Factor for strength of diagonal seams and patches	
Angle, deg.	Sine	Sine, squared	Cosine	Cosine, squared	Angle measured with circumferential seam	Angle measured with longitudinal seam
20	.3420	.1170	.9397	.8830	1.717	1.047
21	.3584	.1284	.9336	.8716	1.700	1.052
22	.3746	.1403	.9272	.8597	1.678	1.057
23	.3907	.1526	.9205	.8743	1.657	1.063
24	.4067	.1654	.9135	.8345	1.635	1.068
25	.4226	.1786	.9063	.8214	1.614	1.074
26	.4384	.1922	.8988	.8078	1.594	1.079
27	.4540	.2061	.8910	.7939	1.572	1.087
28	.4695	.2204	.8829	.7795	1.552	1.094
29	.4848	.2350	.8746	.7649	1.531	1.102
30	.5000	.2500	.8660	.7499	1.510	1.109
31	.5150	.2652	.8572	.7348	1.492	1.117
32	.5299	.2808	.8480	.7191	1.474	1.126
33	.5446	.2966	.8387	.7034	1.455	1.134
34	.5592	.3127	.8290	.6872	1.437	1.141
35	.5736	.3290	.8192	.6711	1.419	1.152
36	.5878	.3455	.8090	.6545	1.401	1.162
37	.6018	.3622	.7986	.6378	1.385	1.171
38	.6157	.3791	.7880	.6209	1.368	1.182
39	.6293	.3960	.7771	.6039	1.353	1.192
40	.6428	.4132	.7660	.5868	1.340	1.204
41	.6561	.4305	.7547	.5696	1.322	1.215
42	.6691	.4477	.7431	.5522	1.306	1.227
43	.6820	.4651	.7314	.5349	1.292	1.239
44	.6947	.4826	.7193	.5174	1.278	1.252
45	.7071	.5000	.7071	.5000	1.264	1.264
46	.7193	.5174	.6947	.4826	1.252	1.278
47	.7314	.5349	.6820	.4651	1.239	1.292
48	.7431	.5522	.6691	.4477	1.227	1.306
49	.7547	.5696	.6561	.4305	1.215	1.322
50	.7660	.5868	.6428	.4132	1.204	1.340
51	.7771	.6039	.6293	.3960	1.192	1.353
52	.7880	.6209	.6157	.3791	1.182	1.368
53	.7986	.6378	.6018	.3622	1.171	1.385
54	.8090	.6545	.5878	.3455	1.162	1.401
55	.8192	.6711	.5736	.3290	1.152	1.419
56	.8290	.6872	.5592	.3127	1.141	1.437
57	.8387	.7034	.5446	.2966	1.134	1.455
58	.8480	.7191	.5299	.2808	1.126	1.474
59	.8572	.7348	.5150	.2652	1.117	1.492
60	.8660	.7499	.5000	.2500	1.109	1.510
61	.8746	.7649	.4848	.2350	1.102	1.531
62	.8829	.7795	.4696	.2204	1.094	1.552
63	.8910	.7939	.4540	.2061	1.087	1.572
64	.8988	.8078	.4384	.1922	1.079	1.594
65	.9063	.8214	.4226	.1786	1.074	1.614
66	.9135	.8345	.4067	.1654	1.068	1.635
67	.9205	.8473	.3907	.1526	1.063	1.657
68	.9272	.8597	.3746	.1403	1.057	1.678
69	.9336	.8716	.3584	.1284	1.052	1.700
70	.9397	.8830	.3420	.1170	1.047	1.717

Rule—To find strength of joint of patch, when at an angle with the longitudinal or circumferential seam multiply strength of corresponding seam or patch by factor in table opposite desired angle.
Formulas for determining factors =

$$2 \div \sqrt{1 + 3 \text{ sine}^2 Y} \text{ and } 2 \div \sqrt{1 + 3 \cos^2 X}$$

Referring to Fig. 2, A-B-C is a right-angle triangle, in which AB equals $8\frac{1}{2}$ in. and BC equals $11\frac{3}{4}$ in. These dimensions are obtained from the seam in Fig. 1, where AB would equal one-half the pitch of the outside row of rivets, and BC, the total circumferential spacing of the first five rows of rivets or $2\frac{15}{16}$ in. $\times 4 = 11\frac{3}{4}$ in.

To find the length of AC in Fig. 2:

$$AC = \sqrt{AB^2 + BC^2}$$
$$AC = \sqrt{(8.5)^2 + (11\tfrac{3}{4})^2}$$
$$AC = 14.5 \text{ in.}$$

The sine of angle Y is equal to AB divided by AC:

$$\text{Sine angle } Y = \frac{8.5}{14.5} = .5862$$

Referring to standard tables of natural trigonometrical functions we find that .5862 is the sine of a 35-deg. 53-min. or 36-deg. angle.

The efficiency of the rivets in the diagonal row is now obtained from the following formula:

$$E = \frac{(L - 4D) \times TS \times t}{L \times TS \times t} \times K$$

Where

E = Efficiency of diagonal row of rivets.
L = Length of diagonal row of rivets = 14.5 in.
D = Diameter of rivets after driving = $1\frac{5}{32}$ in.
TS = Tensile strength of plate = 55,000 lb.
t = Thickness of shell plate = $\frac{3}{4}$ in.
K = Constant allowed for diagonal row of rivets, taken from Table I = 1.401.

Substituting in the formula we have:

$$E = \frac{[14.5 - (4 \times 1.15625)] \times 55{,}000 \times .75}{14.5 \times 55{,}000 \times .75} \times 1.401$$

$$E = \frac{407{,}343}{598{,}125} \times 1.401$$

$$E = 95.4 \text{ per cent}$$

Breaking in Locomotives At San Bernardino Shops

At the Atchison, Topeka & Santa Fe locomotive shops, San Bernardino, Cal., locomotives are turned over to the operating department already partially "broken in" for revenue service. The breaking-in operation is performed as soon as a locomotive comes off the shop firing line, when it is placed on a well oiled slip track and operated at relatively slow speeds for several hours until the main journals have reached a steady temperature. The locomotive is then stopped over an outside pit, the wedges adjusted, minor finishing operations completed and any defects which may be found corrected. Freight locomotives are subsequently operated in helper service and passenger locomotives in secondary service before being placed on call for heavy fast runs with important trains.

While a locomotive is on the firing line, the tank is coupled and the locomotive fired up, the pops being set if necessary, the brakes tested and adjusted, all leaky joints tightened, and injectors, lubricators and air pumps tested. The locomotive then moves to the slip track, with all wedges free, rod grease cups filled, lubricators filled, all driving-box shoes and wedges, hubs, journals, etc., properly lubricated. The oil rigging is applied in two parts. One connects to the oil-tank drain line, which leads to a crossover pipe over the right and left rail, where a trickle of fuel oil is allowed to drip on each rail in about match size drops. The second part is connected to the tank heater drain pipe and supplies steam to keep the oil fluid and flowing freely to the rail even in the coldest weather. A low-gravity oil is used.

The slip track consists of 900 ft. of rail, approximately .07 upgrade, west from the shop, with a 55-ft. pit opposite the shop, as shown in the illustration. The locomotive is slipped westbound after making preliminary trip to oil the track. The slipping speed of 12 to 15 m.p.h. is used to warm up the bearings, equivalent to one mile up and back for the first hour. The bearing temperatures are then tried with a Pyro-prod, and usually show from 100 to 120 deg. F., or 15 to 20 deg. above the atmospheric temperature. During the second hour, at a slipping speed of 20 m.p.h. the temperature increases from 15 to 25 deg., and the third hour at 30 m.p.h., the temperature begins to decrease. Locomotives receiving Class 3 repairs are slipped for five hours and Class 4 and 5 repairs for three hours. Wedges on the locomotives are set after $1\frac{1}{2}$ hr. slipping, using a ratchet wrench. In 1940, 497 locomotives had their wedges set up in this manner without a case of hot-box trouble being subsequently reported when the locomotives went into service.

Occasionally a locomotive journal runs warm on the slip track, due to poor fitting wedges or a sticky cellar screen, but this happens not over once or twice a year and is quickly corrected. Operation on the slip track also breaks in the driving rods, valve motion parts and cylinder and valve packing, all of which are watched closely and checked to make sure they are receiving proper lubrication. High operating speeds are not attempted on the slip track as it would cause excessive wear of the rails and introduce some hazard. The locomotive is stopped at the end of each run with cylinder compression controlled by operation of the reverse lever. Sand pipes are plugged with waste.

Santa Fe locomotive on the slip-track pit outside the San Bernardino shops

N. Billerica Wheel Shop

In 1939 it became evident to those responsible for mechanical department maintenance operations on the Boston & Maine that the practice of servicing and repairing wheels and axles at different points on the system could no longer produce the desired results, either from the standpoint of output or of cost. A thorough study was made of current and future requirements of wheels and axles and a new wheel shop was projected upon the underlying principle of concentrating all of the work for the entire system at a point where modern and efficient facilities could be installed and the standards of workmanship properly controlled. As a result, the new shop was located at North Billerica, Mass., where the company's system locomotive shop is situated. The new wheel shop was completed and placed in operation in 1940 and has now passed through the "break-in" period to regular full-time production.

The wheel shop occupies a corner section of the annex building of the main locomotive shop approximately 90 ft. by 200 ft. The arrangement of the facilities is shown in the drawing on page 366. The wheel shop is adjacent to the section in the locomotive shop where the tenders are unwheeled and it is well situated with respect to tracks for the incoming and outgoing wheel sets whether they arrive and depart in railroad cars from outlying points or originate at North Billerica shop.

For convenience in referring to the several facilities in the following description, numerals from one up are used to designate standard-gage tracks; numerals from 101 up, to designate machine tools, and letters, such as A, B, etc., to designate other facilities.

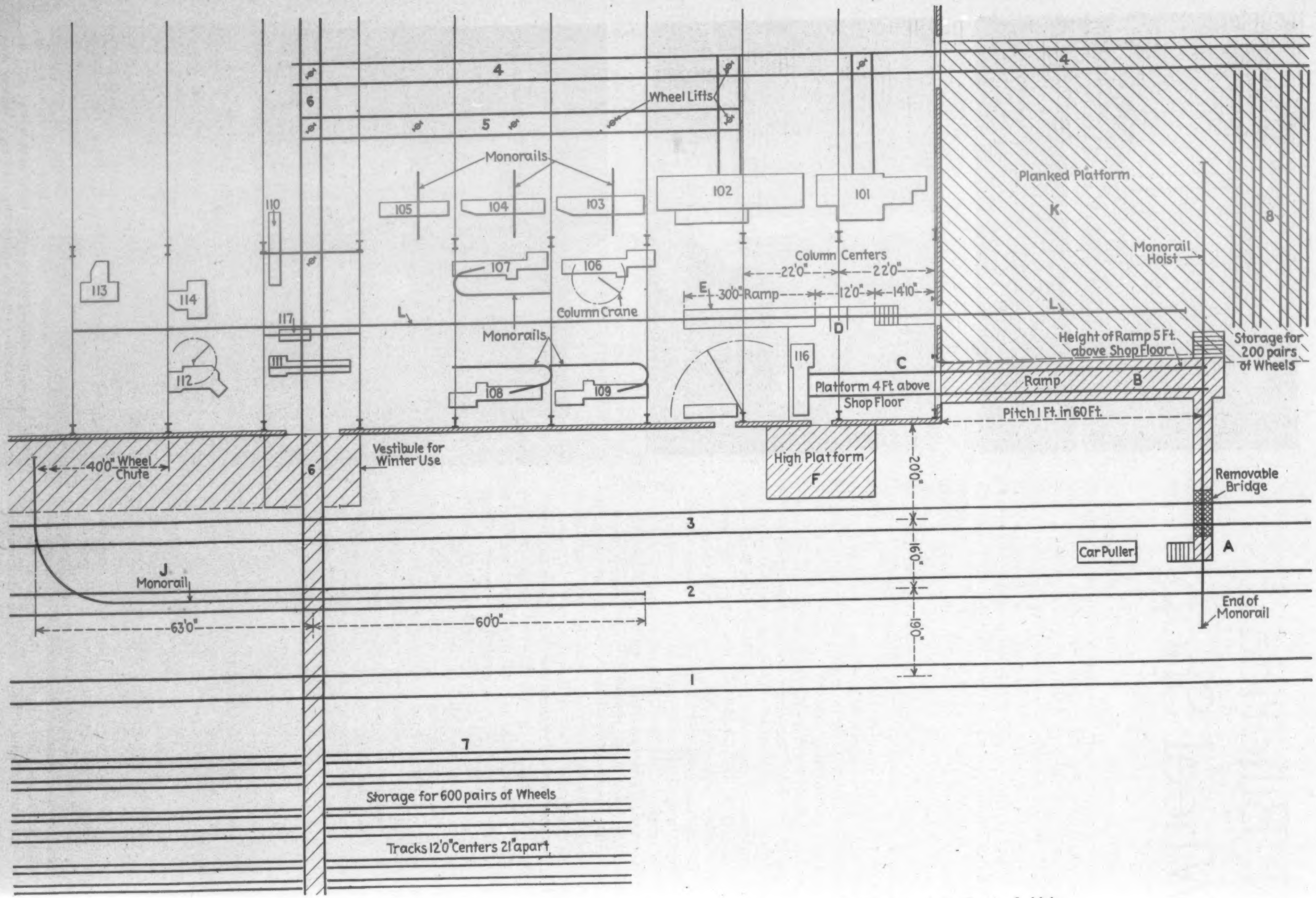
The principal service tracks, identified by Nos. 1 to 4, inclusive, all provide access to the wheel shop area from yard tracks. These tracks are interconnected within the shop yard area by conveniently located crossovers. Track 5 is a stub track in the shop in front of the journal lathes and Track 6 is a transverse shop track of standard gage which goes through the entire shop from the wheel storage area 7 on the south side of the wheel shop to the material storage area between the main longitudinal locomotive machine and erecting shop and the storehouse and office building.

Perhaps the simplest method of describing these facilities and their use is to follow the course of wheel sets through the shop. In general, the problem of the wheel shop is to handle (1) mounted wheel sets which must be demounted, axles refinished, and mounted with new chilled-iron or steel wheels; (2) mounted wheel sets which must have wheel treads returned with or without axle-machining operations; (3) mounted wheel sets on which only the journals need refinishing, and (4) the make-up of new wheel sets to meet additional requirements of service or to replace wheels and axles that have reached condemning limits and must, of necessity, be scrapped.

Wheel sets, such as those in Group 1, arrive in greater quantity on cars from outlying points. The cars are spotted by the car puller at platform *A* where the wheels are unloaded by a Shepard-Niles 4,000-lb. capacity electric monorail hoist and set down on the track at the end of inclined runway *B* which leads into the shop and to

Top: The high end of the inclined ramp on which the wheels are unloaded—Center: The corner of the shop at the demounting press — Bottom: The crane over the planked storage platform

the demounting press, or they are carried on over to storage tracks 8. Wheel sets of Group 2 are carried over to storage or directly to Track 4 and to wheel lathes 101 or 102. Wheel sets of Group 3 requiring journal turning enter the shop by way of Track 4 and are handled on lathes 103, 104 and 105. Lathe 103 specializes on engine-truck wheels, while machine 104 handles car wheels. Lathe 105 handles such mounted wheel sets as can not be handled on the other two lathes. Wheel sets



Drawing showing the location of the important facilities at the North Billerica, Mass. wheel shop of the Boston & Maine

Shop Machinery at North Billerica Wheel Shop

Mach. No.	Description of machine	Date acquired	Special equipment	Motor, hp., a.c.
101	44-in. Putnam car-wheel turning lathe	1914	....	......
102	50-in. Sellers car-wheel turning lathe	Sept., 1940	Face plate inserts for roller-bearing journals; Ingersoll-Rand 6,000-lb. air hoist.	50
103	Betts - Bridgeford four-carriage, gap type journal-turning lathe	1929	....	15
104	Consolidated journal-turning lathe	Dec., 1940	Stellite burnishing rolls, turret tool posts	15
105	50-in. New Haven journal-turning lathe	1914	....	Belt driven
106, 107, 108, 109	Putnam axle lathes	......	....	......
110	400-ton, R.D. Wood demounting press	1914	....	7½
111	400 - ton Chambersburg single - end mounting press	1925	....	10
112	52-in. Betts hydraulic car-wheel boring mill	Feb., 1941	Oilgear hydraulic control	15
113, 114	Putnam car-wheel boring mills	1925	Chain hoist	15
115	Whiton centering machine	1926	....	2
116	400 - ton Chambersburg single-end demounting press	1927	....	10

that come to the wheel shop from inside the locomotive shop building may reach the wheel and journal lathes by way of transverse Track 6 and thence by 4 or 5, or, after reaching the intersection of either of these tracks with Track 6, may be handled within that shop bay by overhead traveling crane.

Returning again to the wheel sets that enter the shop via the inclined track on runway *B*, these may be set down by the hoist on this runway to the capacity of a full flat-car load. They move to the demounting press 116 by gravity. After the wheels have been pressed off the scrap chilled-iron wheels are rolled directly out the adjacent doorway, across platform *F*, and loaded into a car at that platform. Second-hand unmounted steel and scrap steel wheels are stored on that platform. After the axle, with two loose wheels, is rolled out of the demounting press it is rolled over to the short, inclined track *D*, and, as the wheels are removed from the axle ends, the axle drops to the track rails and rolls down to a position immediately under the monorail hoist *L*. This monorail runs from the outside storage platform *K* through the east shop wall and down the entire length of the wheel shop area to the boring-mill section. It clears the shop floor by 12 ft. and is equipped with two Shepard-Niles 1,000-lb. electric hoists. By means of this monorail the axle, if it is to be stored or scrapped, may be moved out to platform *K* or carried in the other direction to the floor storage adjacent to the four axle lathes 106, 107, 108, and 109. For the convenience of the operator of the monorail-hoist control steps lead in the direction of the outside storage platform from the demounting platform and, directly under the monorail leading in the direction of the axle-lathe section, there is a ramp, *E*, which is 30 ft. long.

Three of the axle lathes, as well as the journal lathes

Top: The demounting press is located on a platform at car-floor level; Bottom: the hoist for handling axles to the storage floor

SHIPPED FROM ....
DATE .... 19 ...
IN .... CAR NO. ....

BOSTON AND MAINE RAILROAD

RECORD OF WHEELS AND AXLES REMOVED FROM FOREIGN CARS

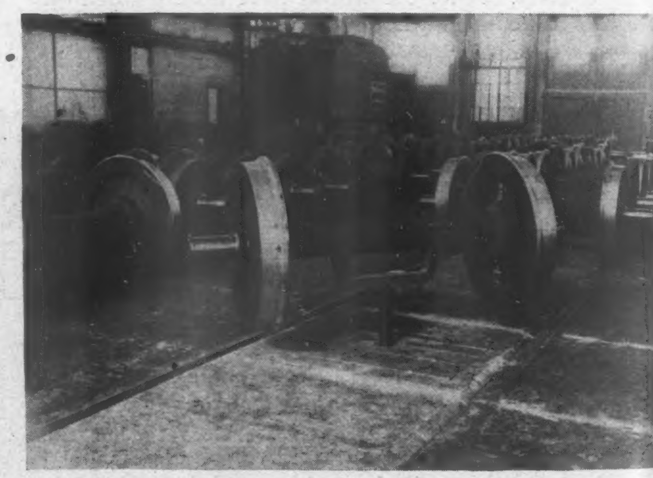
REMOVED FROM CAR		WHEELS	AXLES	KEY
INITIAL	NUMBER			

Wheel Defects

Axle Defects

The axle-storage floor in the turning department as seen from the top of the inclined 30-ft. ramp from the demounting press

Wheel lifts are located at several track intersections



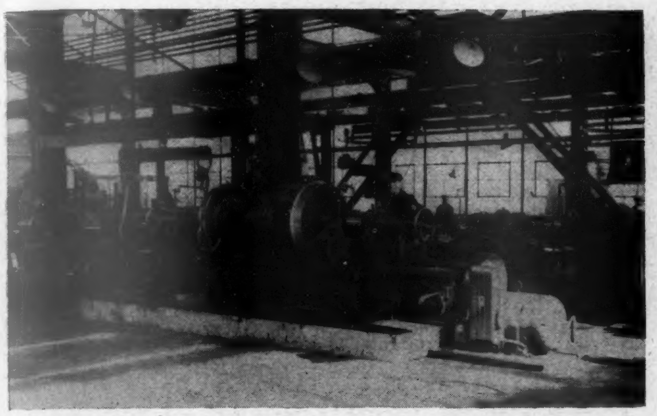
(six machines in all), are equipped with their own 2,000-lb. capacity overhead monorail hoist. In the case of the axle lathes, the location of these hoists is such that the axles may readily be picked up from the floor where they have been put down by the monorail hoist, *L*, and placed in the centers of the lathe. Centering machine 115 and axle lathe 106 are served by jib or column cranes with hoists.

At nine intersection locations on Tracks 4, 5, and 6 pneumatic wheel lifts are set into the floor. These lifts have a cradle that comes up under the axle. When the wheels have cleared the rail or floor, the cradle acts as a turntable. The lifts are operated individually by foot controls.

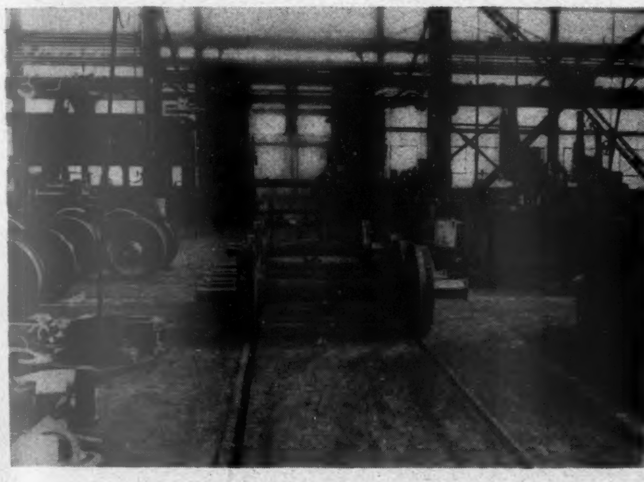
Wheels from the boring-mill section and axles from the axle section meet at mounting press 111 on Track 6. After the mounting operations have been completed, the wheel set is rolled through the press on Track 6 to the outside where it is either picked up by another monorail hoist, *J*, and loaded onto outgoing cars on Track 2, or passed on to the yard storage track 7 where there is space for 600 wheel sets. The movement from Track 6 to these storage tracks is made with wheel sticks. Mounted wheel sets from the wheel-turning or journal lathes move by way of Track 6 through the same exit.

Record of Production at North Billerica Wheel Shop

	1940				1941					
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
Cast-iron wheels demounted, pairs	952	941	1,181	1,017	833	907	1,287	1,397	1,097	856
Steel wheels demounted, pairs	56	98	66	64	110	58	107	67	108	61
Treads turned on mounted steel wheels, pairs	214	271	284	253	223	223	265	203	191	239
Treads ground on mounted cast-iron wheels, pairs	0	0	0	0	0	0	0	0	0	0
Treads ground on mounted steel wheels, pairs	0	0	0	0	0	0	0	0	0	0
Journals turned and burnished, mounted wheels, pairs	467	595	340	353	371	273	316	270	246	368
Cast-iron wheels bored, (No. of wheels)	...	...	...	1,492	1,604	1,668	2,224	2,289	2,202	1,572
Steel wheels bored, (No. of wheels)	...	...	...	230	188	228	348	238	240	194
New axles turned and burnished	0	0	0	0	0	0	0	0	0	0
Cast-iron wheels mounted, pairs	477	509	799	828	838	799	1,179	1,147	1,085	862
Steel wheels mounted, pairs	123	67	36	46	41	52	98	52	51	58
No. of eight-hour days worked	24	27	25	25	26	23	26	26	26	25

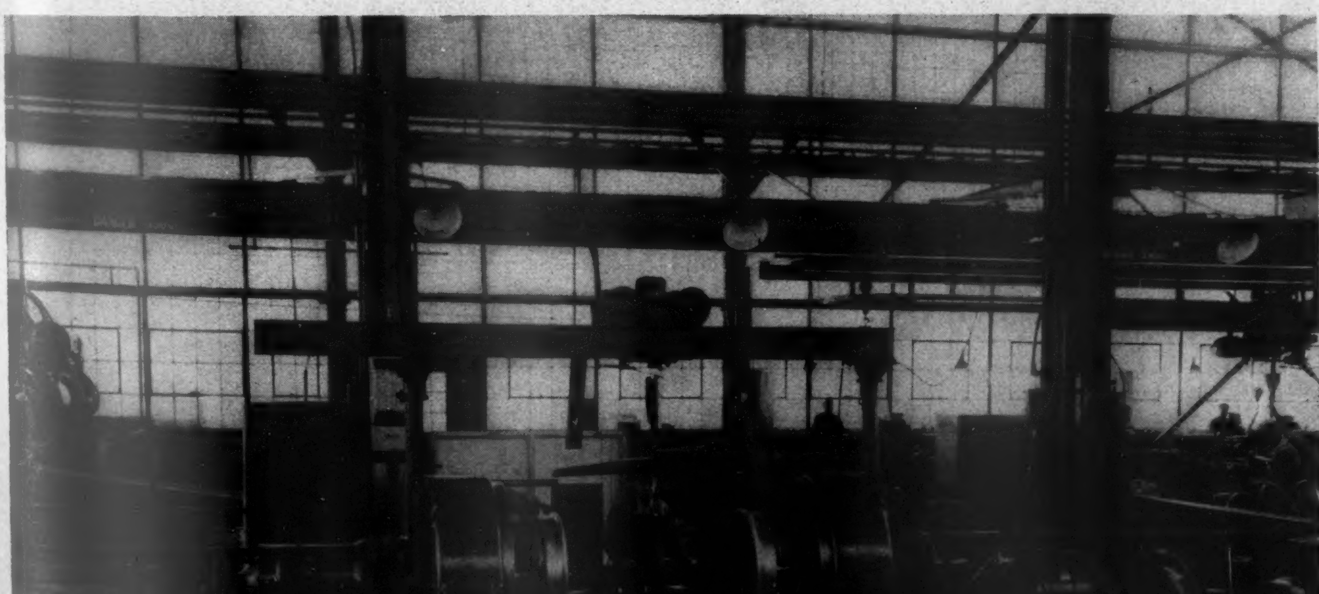


One of the modern lathes for turning journals on mounted wheels



The transverse shop track leading to the mounting press

This hydraulically controlled car-wheel boring mill is one of three machines that care for all of the wheel-boring work for the entire shop preparatory to furnishing wheels to the adjacent assembling location where the wheels and axles meet at the mounting press. At the bottom of the page is shown a new car-wheel turning lathe equipped to handle axles fitted with roller bearings without removing the bearings



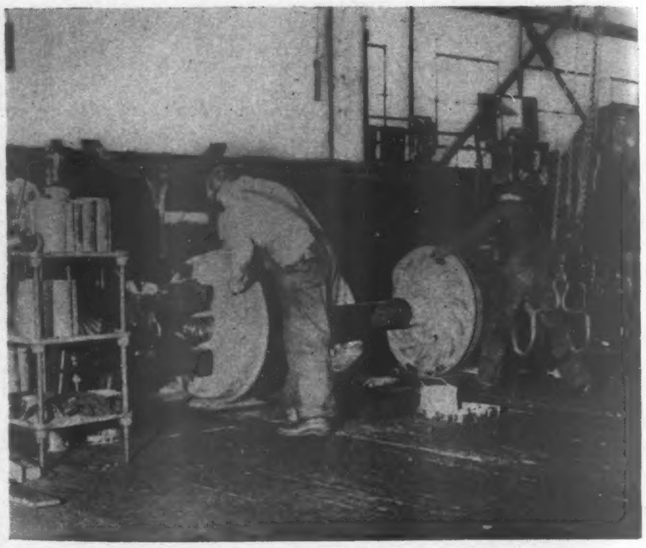
Any remounting that may be necessary is handled on the 400-ton press 110.

Thorough inspection of all incoming wheel sets is made to check the defects for which the wheels or axle were removed and sent to the shop. The record form used by the road is shown on an accompanying page. Likewise, wheels and axles are inspected at all stages of their passage through the shop and a final inspection is made before they are released for shipment to outlying points or otherwise placed in service.

The table accompanying the shop layout drawing lists the various machines in the shop, their date of acquisition, special equipment other than that normally found on such machines, and the data relating to the motors which drive them.

Another table accompanying this article shows a tabulation of the production of the North Billerica wheel shop over a period of several months and offers means of evaluating the output of the several machines and of the shop as a whole.

This article is designed to describe the facilities and the manner in which they are used. The detail machining practices are, in general, in accordance with the recommendations of the A. A. R. Wheel and Axle Manual.



Top: A pair of wheels being handled in the mounting press—Bottom: Finished wheels are loaded by crane on cars

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Responsibility for Cars Damaged While Located on Private Track

On the afternoon of January 28, 1939, the Mobile & Ohio placed 13 empty cars on track No. 1, empty yard, at the Southwestern Illinois Corporation mine at Percy, Ill. About 7:30 p. m., January 29, 1939, these cars rolled out of that track, collided with a partly loaded car under the tipple, the 14 cars then moving into the load yard where they collided with and derailed one New York Central car and five Missouri Pacific cars, causing damage totaling $1,158.54. These six cars were placed in the joint mine yard by the Mo. Pac. The trackage on which the Mo. Pac. cars and the M. & O. cars were located, as well as that over which the M. & O. cars ran, is owned and maintained by the Southwestern Illinois Coal Corporation. The Mo. Pac. contended that the M. & O. was responsible for the damage, to which the latter disagreed. The Mo. Pac. contended that Rule 113 does not apply as the damage was not caused by an industry or non-subscriber but was due solely to negligence of the M. & O. in failing to set sufficient hand brakes or to block the cars so they would not roll off this inclined track. The M. & O. stated that the accident occurred 29½ hr. after the cars had been placed on the track. The statements of the M. & O. train crew revealed that the hand brakes on these cars were set after an emergency application of the air brakes had been made and the M. & O. stated that it is a well-known fact that when a hand brake is set while the air brakes are in emergency position, it is almost impossible to release the brakes without using brake sticks. The M. & O. did not know how or when the brakes were released on these cars but it claimed it had been shown that a sufficient number of hand brakes were set, even to the extent of one of the cars having sliding wheels. The M. & O. contended that Arbitration Case No. 1493 is somewhat parallel and, therefore, it believes the responsibility rested with the railroad placing the damaged cars on the tracks of the mining company which, in this instance, was the Mo. Pac.

In a decision rendered November 14, 1940, the Arbitration Committee stated: "The contention of the Missouri Pacific is not sustained. Rule 113 governs."—*Case No. 1780, Missouri Pacific versus Mobile & Ohio.*

Journal Packing Mixer

An efficient journal packing mixer, now being used at the Centralia, Ill., car shops of the Illinois Central, is shown in the illustrations which give a general view of the mixer in Fig. 1, and a drawing with principal dimensions in Fig. 2. This machine is used to assure that packing as applied in journal boxes has oil and waste in the same proportion as when it left the reclamation plant, where oil and waste are carefully weighed sep-

Fig. 1—Journal packing mixer used at the Illinois Central car shops, Centralia, Ill.

arately to know that the correct amount of both are placed in each container for delivery to the shop.

This machine is operated as follows: Two barrels of saturated waste are placed in the mixer which is turned for 5 min.; the box packers then take the packing in small lots to the car to be repacked and it is placed in the boxes a few minutes after ariving there and before any separation or settling of the oil can take place. All cars are repacked, both heavy and light repair cars passing in close proximity to this machine, from which the packing is delivered across the shop instead of lengthwise of it.

Experience indicates that the turning of packing in

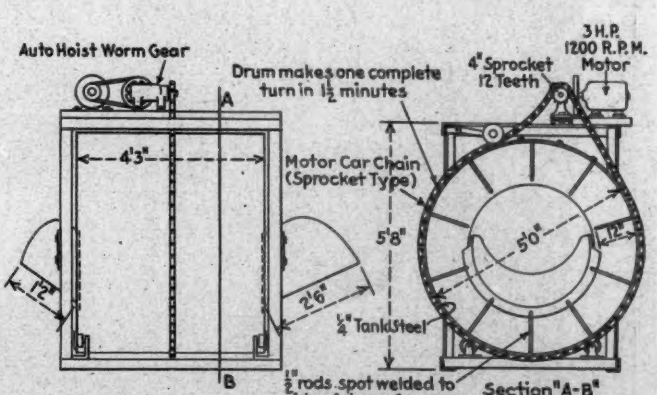


Fig. 2—General arrangement and principal dimensions of the journal packing mixer

an ordinary barrel or container is helpful but does not assure the right mixture, and the labor cost of doing this is double that required with the mixer illustrated. This arrangement also keeps all packing at one location and simplifies delivery service. The mixer is located in a small fireproof steam-heated building and a year's use demonstrates that it has contributed materially to reductions in hot boxes.

Lightweight Car Repaired With Ordinary Shop Tools

The illustrations show both the tools and method used in repairing a welded alloy-steel box car, built by the Pullman-Standard Car Manufacturing Company, which became derailed while loaded to the roof with cedar logs and moving down a descending grade with a 10-deg. curve at a speed of 12 to 15 miles an hour. Eight other cars were involved in the derailment.

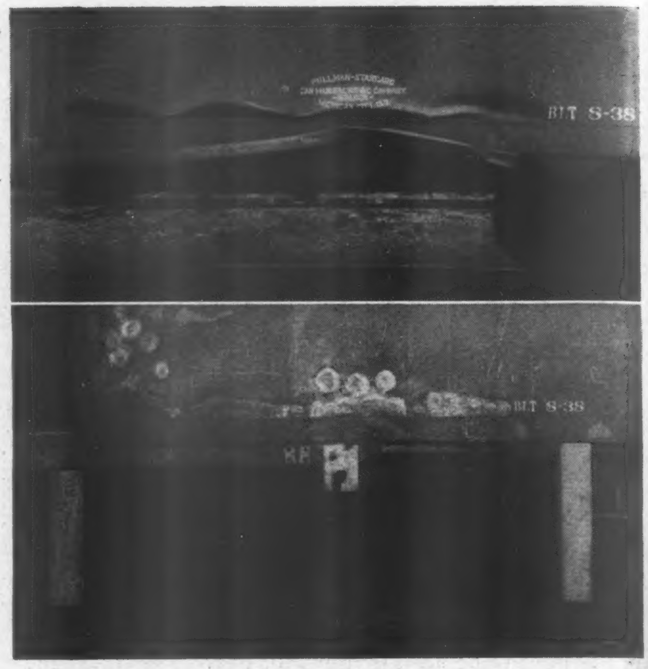
The damage to this welded car was readily repaired by the use of the simple tools illustrated, such as are available in any car shop. After repairs, the car was thoroughly water tested. It showed no leakage and was again accepted for service. No rivets were applied except where used originally in the car.

How the Defective Parts Were Removed

The longitudinal running boards were removed by the usual method. The latitudinal running boards were taken off by unbolting at the center support and cutting out four rivets through the side plates. The damaged steel side supports and the handhold were straightened off the car without removing the lumber.

All side lining and a portion of the end lining were removed by setting the nails through the boards into the nailing strips. The grain strips were scrapped, as removed. None of the flooring was removed, but about 2-in. diameter holes were cut in the floor at the side sill to permit removal and replacement of the side step and the door track rivets. All rivets were cut out with a pneumatic chipping hammer, or chisel. The side ladder and the door track were removed from the car and straightened hot on a face plate.

Intermediate roof sheets were removed by cutting with the pneumatic chisel along the edge of the carline and the inside face of the top end sheet and the side plate. The track-welded part of the roof remaining at the side plate was pried loose and the welded spots ground smooth. The remaining roof sheets were bulged up approximately 6 in. at the center and the carlines were similarly buckled, narrowing the car at the top.



(Above) Damaged side sill, door track and side sheets—(Below) Turnbuckle used in hot straightening the side sill and stiffener

Above: Damage at one end of the car caused by the derailment

Below: Damaged roof sheets and portion of side plate removed—Two new side sheets in position

In straightening the roof, three oak timbers 10 in. by 6 in. by 10 ft., made up from 10-in. by 2-in. by 10-ft. pieces spiked together, were sawed to fit the contour of the roof to a 21-ft. radius. These timbers were placed on the roof directly over the carline and then weighted with about a 1,500-lb. die block, as shown in one of the illustrations. Inside the car from side plate to side plate, a pipe screw jack was used, and as the carlines were straightened cold with a special "dog" wrench, the strain on the screw jack with the weight of the die block on top of the buck-up timbers brought the car to proper width and at the same time, forced the remaining roof sheets back to their proper contour position.

The new roof sheets were punched with a single row of $\frac{3}{16}$-in. holes spaced $1\frac{3}{4}$ in. at the side plate and end sheet connections and with a double row of $\frac{3}{16}$-in. holes on the same centers across the roof sheets. The new sheets were clamped down and electric welded through the small holes, with a continuous electric weld across the joint lap from side plate to side plate. The carlines were straightened as far as possible cold, with a hand hammer and buckup block and were then welded where cracked.

The carlines were straightened with this hand tool

Method of Repairing the Damaged Side Sheets

The damaged side sheets, after ladder and end-sheet rivets were removed, were cut loose with the pneumatic chisel along the line of the side plate, side sill, and side post. The small section of sheet remaining was torn loose from the sill and weld spots ground flat. In cold straightening the side sheets remaining on the car, the top of the car was braced from side plate to side plate and then pulled together with a turnbuckle, using a wooden ram to strike the sheets directly over the side posts. To protect the sheets from damage, a wood buffer strip was placed along the edge of the post from side plate to side sill. The buckles in the intermediate side sheets were straightened at the side sill by drilling through at the weld spots to loosen the sheet; then heating the buckles with a torch and straightening with a hand hammer, the weld spots were ground flat and the sheets re-welded through the drilled holes. Drilling through the weld spots was found to be the only satisfactory method of loosening the side sheets without tearing them at the weld. On the new side sheets, $\frac{3}{16}$-in. holes were punched at the side plate, side sill, and joint lap. After the sheets were clamped in position, they were welded through the small holes and also the full length of the lap.

The damaged section of the side plate, at both ends of the car, was cut out with a torch, the ends squared and beveled with the pneumatic chisel and a new section of side plate was then fitted and welded on both sides. The top end sheet was reinforced by welding a $\frac{3}{16}$-in. plate at the end of the side plate. The side posts were straightened, both hot and cold, on the car, using a torch, hand hammer, steel buck-up block and "doh" wrench and were welded where fractured.

Pulling Device Used in Straightening Side Sill

The side sill was straightened hot with a special pulling device, as illustrated, made from a steel rail to which was welded a $\frac{3}{4}$-in. slotted plate. Directly above the

Ordinary shop tools used in repairing damage to welded alloy-steel freight car

slotted plate on the rail, a similar plate was welded to the side sill and a turnbuckle applied at this point, while at each end of the rail one 8-in. by 8-in. wood block was placed under the crossbearers. As the sill was heated, pressure was applied at the turnbuckle, and the sill brought back to its proper position. Due to the fact that the sill was bent both upward and toward the center of the car, a screw jack was also placed between the center sill and the flange of the side sill. As the sill was heated, this jack was used to force the sill out to position. The wood floor at this point was loosened and pushed up slightly from the side sill flange. This was done to prevent the burning of the floor when heating the sill.

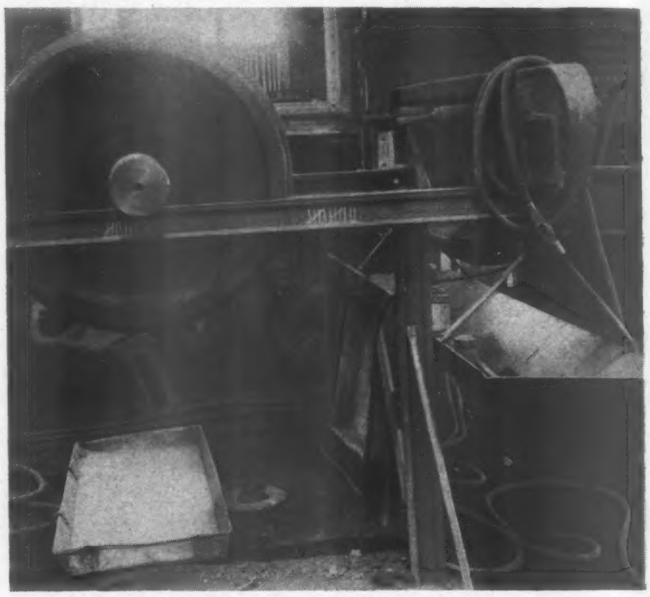
The side-sill stiffener was straightened hot on the car. The AB valve was removed for clearance and holes drilled through the stiffener. One-inch plates were then fitted inside the stiffener and bolted through the drilled holes, while C-clamps, attached to a short steel rail, were fastened to the outside of the stiffener. As heat from the torch was applied, by tightening the bolts and C-clamps, the stiffener was brought back to position. A few remaining kinks were "ironed out" with a No. 90 pneumatic hammer, using a flat die with buck-up block. Two drilled holes were welded shut.

The damaged flange of the end sheet, where riveted to the side sheet, was straightened hot by clamping a steel rail the full length and using a flatter, sledge, and torch. Torn places on the end flange were welded. The inside corner posts, which were cut out with a torch where they were welded to the end sheet, were replaced by welding.

The doors were removed from the car for straightening. A section of door sheet immediately back of the stiffener was cut out, and the stiffener then straightened through this opening with a small, narrow flatter. A patch was then welded to the door sheet on the inside where cut out. The door stiles were straightened hot on a face place and welded where broken. The door posts were straightened on the car by heating in various places and jacking from opposite side. Fifty per cent of the wood inside lining was reclaimed and reapplied.

Magnafluxing Car Axles And Truck Side Frames

The special equipment used in Magnafluxing all freight-car axles, truck sides, bolsters, etc., at the Burnham shops of the D. & R. G. W. is illustrated. Car axles are rolled along the elevated rails, and tested in the usual



Special equipment for Magnafluxing car axles and truck sides at the Burnham shops of the D. & R. G. W.

manner, a pan being used to catch the Magnaflux powder for re-use. Truck sides and bolsters are first annealed with careful attention to the initial temperature and rate of cooling. Wire brushing then cleans the surfaces for thorough inspection, and the truck sides and bolsters are moved to the elevated rails. To catch the powder, a large

Formed oak timbers and 1500-lb. die block used in straightening the car roof

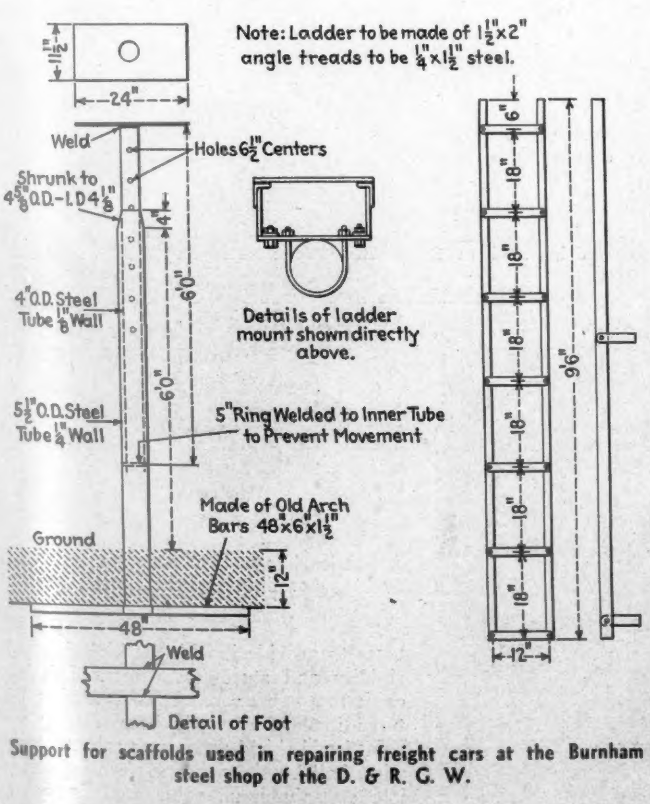
sheet metal tray is suspended under the truck side. The Magnaflux operation shows up any concealed surface cracks or potential defects. The sheet metal tray is 14 in. wide by 9 in. deep by 7 ft. long. The other tray under the wheels is 18 in. wide by 4 in. deep by 52 in. long.

An examination of the record of car axles, truck side frames and bolsters tested by the Magnaflux method at Burnham shops for a single week shows 47 axles inspected, of which only one was condemned. Out of 24 side frames inspected, 17 were found O. K., and seven condemned. Out of 12 bolsters inspected, three were found O. K., nine condemned. As of July 5, 1941, the record at Burnham shops for 319 cars shows 1,276 side frames inspected, 1,028 found O. K., and 248 condemned. During this period, 638 bolsters were inspected, of which 356 were O. K., and 282 condemned. Of 1,275 axles inspected, 1,270 were found O. K., and five condemned.

Steel Freight Shop Scaffold

The scaffolding illustrated was made with scrap locomotive boiler flues used for the posts. The main posts measure 5½ in. in diameter and 6 ft. 4 in. in length, and have the reduced bottle end up. Within this bottle end, which has an inside diameter of 4⅛ in., slides the inside post which is 4 in. in diameter and 6 ft. long.

To take up the play between the bottom end of the inner post and the outer post, a 2-in. collar is welded to



Support for scaffolds used in repairing freight cars at the Burnham steel shop of the D. & R. G. W.

the bottom of the inner post. A plate of second-hand tank steel, ⅜ in. by 11 in. by 24 in., is welded to the top end of the inside tube and is punched for easy fastening of the scaffolding.

A scrap arch bar, 1⅜ in. by 6 in., cut to a length of 48 in., is used for the base. This bar, together with two 20-in. pieces, are welded to form a cross. The post is welded in place at the intersection.

To adjust the height of the scaffolding, an 1¹⁄₁₆-in. hole is drilled through the outside tubing 1¼ in. from the top. A ⅝-in. key bolt is inserted into the hole, and also through any one of the nine holes of the same size drilled through the inner post and spaced at 6-in. intervals. The scaffold can thus be raised or lowered by sliding the inside tube up or down within the outer tube. The full height will reach 11 ft. 6 in.

A jig was made for welding the top and bottoms to the tubes. One welder was able to weld seven posts in eight hours. This jig, together with the scrap material, kept the cost of the scaffold posts relatively low.

Air Brake Questions and Answers

AB-8, Empty and Load Equipment (Continued)

14—*Q.—How does the ABEL-1 valve compare with the AB valve?* A.—It has the same operating parts as the AB valve. It has a special pipe bracket with an additional pipe connection, the purpose of which is to supply brake-pipe air to the change-over valve.

15—*Q.—Are the pipe connections to the ABEL-1 valve the same as the standard AB equipment?* A.—All except the brake-cylinder pipe, which is connected to the change-over valve.

16—*Q.—What is the function of the change-over valve?* A.—To direct the flow of air from the ABEL-1 valve to the brake cylinders in accordance with the empty or load setting.

17—*Q.—What portions comprise the change-over valve?* A.—As shown in Figs. 5 and 6, it has four portions: pipe bracket (*85*); cut-off valve portion (*65*); change-over portion (*2*) and transfer valve portion (*40*).

18—*Q.—What is the purpose of the pipe bracket?* A.—It provides for all pipe connections and contains two chambers.

19—*Q.—What are there two chambers?* A.—Brake-cylinder volume and strut-cylinder volume.

20—*Q.—What is the purpose of the brake-cylinder volume?* A.—To provide a constant pressure-volume ratio between the brake-cylinder pressure development and the brake-pipe reduction when in empty position, which is a basic feature of the standard single-capacity AB brake.

21—*Q.—How is this accomplished?* A.—By connecting the brake-cylinder volume to the empty brake cylinder in empty position, the combined volume of the chamber and the 8-in. cylinder is equivalent to that of a 10-in. brake cylinder. As the standard auxiliary reservoir volume is used, the pressure-volume relationship between the auxiliary reservoir and the brake cylinder is that of the standard AB single-capacity brake. In load position the volume is cut out for the reason that with the load cylinder cut in the combined volume of the empty and load cylinders equals that of the 10-in. brake cylinder.

22—*Q.—How is the entry of insects through exhaust ports prevented?* A.—By the use of wasp-excluder fittings in the exhaust openings in the bracket and in the cut-off portion.

NEW SHOP TOOLS AND EQUIPMENT

Cleaning Car Heating And Cooling Coils

An air gun designed specifically for cleaning heating and cooling coils of air-conditioned club cars, diners, coaches and other passenger units and which is said to speed-up and simplify this maintenance work has recently been developed by Oakite Products, Inc., New York. Known as the Oakite Solution-Lifting Air Gun, Model No. 391, this device makes it practical to clean heating and cooling coils of many types of air-conditioning equipment in place, thereby eliminating the necessity of taking out units from cars and cleaning them manually.

For operation the gun uses compressed air of from 40 to 90 lb. pressure, and requires hose for both air and cleaning solution. The solution is made up with a special, water-soluble material, Oakite Penetrant. For air pressure up to 50 lb., an air hose of ¾ in. inside diameter is recommended to assure the most effective results. For pressures of 50 lb. or more, an air hose of ½ in. inside diameter is recommended.

The gun is one foot in length and weighs 2 lb.

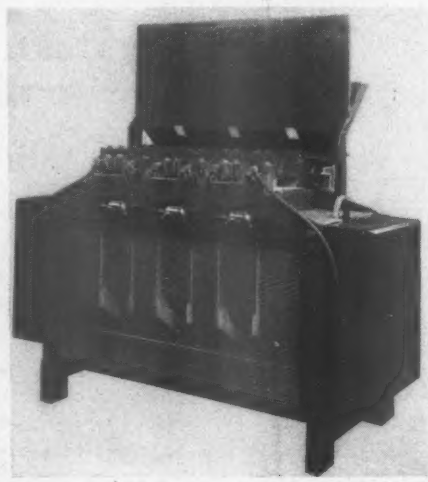
Oakite solution-lifting air gun

Electric Heaters for Forging Machines

The illustrations show two electric metal heaters, for use preparatory to bolt heading or otherwise upsetting the ends of bars in forging machines, which are built by the American Car and Foundry Company, New York.

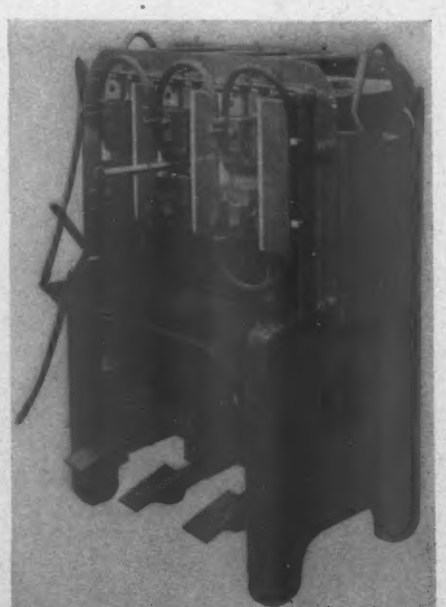
The No. 5 heater is a type of which eight are in service in a General Motors plant for making drag links. The bar to be heated is gripped by the electrodes, the portion of the bar between the electrodes being heated prior to upsetting and piercing. In producing grab-handles and ladder rounds in the car shop about 5½ to 6 in. at the ends of the bars would be heated.

The No. 5 heater is a three-electrode machine. With all electrodes working, it is capable of producing 300 heats per hour, the equivalent of 150 completed grab handles or ladder rounds.



The Berwick No. 5-3 Type G forging heater

The other illustration shows a Berwick No. 3 three-electrode rivet heater equipped with special blocks for heating 1½ to 2 in. on the ends of bolt stock preparatory to heading in a forging machine. The blocks are water cooled and the machine is capable of a production of 200 to 300 heats an hour, depending upon the diameters. Any diameter from ⅜ in. or smaller up to 1 in. can be heated in this machine.



A Berwick three-electrode rivet heater equipped with special die blocks for use in bolt heading

Machine-Tool Motors Of Small Capacity

A fractional-horsepower motor, built specifically to meet the requirements of machine tools and other industrial applications where frequent start-stop service, plugging, and metal-dust atmospheres are encountered, has been introduced by the General Electric Company, Schenectady, N. Y. It is available in ¼-, ⅓-, ½-, and ¾-hp. sizes for operation on three-phase and d-c systems.

The new motor is of totally enclosed construction and has several design features to provide it with the high degree of rigidity and sturdiness demanded in machine-tool operation. Its outstanding features include a sturdy base, closely machined end-shield and stator rabbets, tough wire, ball bearings, a one-piece indestructible cast-aluminum rotor, and firmly anchored windings. A convenient conduit box built into the totally enclosed endshield contributes to the motor's compactness and pleasing appearance.

A fractional-horsepower motor for three-phase or direct-current systems

The stator is especially designed to withstand the stresses of starts and stops as well as plugging and momentary overloads. Formex, G-E's new heat- and sol-

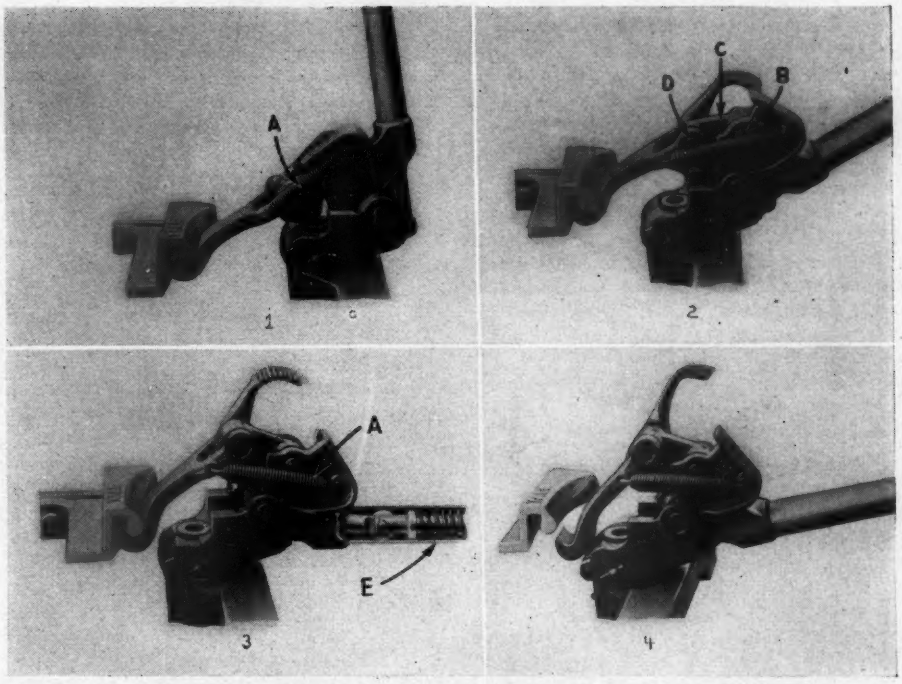
vent-resistant magnet wire, is used for the windings which are wedged in the stator slots and firmly anchored. Both stator and end-shield rabbets are machined to close tolerances, providing concentricity between the rotor and the stator, so that a uniform air gap is maintained.

Ball-bearing assemblies are used in the new motors. This allows the mounting of the motors with the shaft at any angle to the horizontal. End-mounted motors can be placed vertically as well as horizontally and may be obtained for flange, flat-face, or rabbet-machine mounting.

Base-mounted motors are furnished with a sturdy, malleable, cast-iron base, solidly bolted to the stator. The mounting dimensions of this base are similar to those for motors of comparable frame size which have been furnished previously for machine-tool service.

Hand Trucks with Single-Stroke Lift

In its present lines of Red Streak and Blue Streak hand lift trucks the Yale & Towne Manufacturing Co., Philadelphia, Pa., has included a simplified, single-stroke lift feature. There are fewer moving parts and safety features are incorporated in the lift mechanism to prevent tripping and



(1) Ready to lift—The heavy-duty steel lift hook is positively engaged and held securely by spring *A*—It cannot be accidentally disengaged—(2) As the handle descends a change of leverage takes place—The lifting force is shifted from *B* to *D* by the action of the intermediate link *C*—(3) The lift is accomplished and the load is positively locked in place—Secondary safety spring *E* (in handle) is forcing handle up to disengagement position where handle will be free of the load—(4) Secondary spring has raised handle, the handle and the hook automatically drop out of engagement

"flying handle." How this compound lift mechanism changes the lifting ratio, flattens the lift curve, and requires less lifting effort is shown in the illustrations.

Another feature is the balanced handle. The hand grip is larger in diameter to afford better grip, is satin-smooth and chrome-finished to make it easier on the operator's hands. The hand grip, tubular handle shaft, and lower handle casting are welded into a single unit to keep the parts from working loose. The handle balancing mechanism which keeps the handle in an upright position, prevents tripping, and relieves the operator of handle weight is now enclosed in the tubular handle shaft to protect it from outside shock and assure its long life. In addition, a shorter handle stroke is now used and, consequently, less bending effort is required of the operator.

To prevent cornering of this truck in cramped quarters, loads may be elevated with the handle at any point within a 90-deg. arc. Steering may be accomplished through a full 180 deg. For easier rolling, all wheels are steel with a machine-smooth face. Wheels are mounted on ball bearings which are sealed against dirt intrusion by built-in hardened-steel washers.

The front head and steering column are solid steel castings assembled on a fifth wheel with a hardened and ground thrust washer to assure long life and low maintenance.

Both trucks are available in either wide or narrow frame models. The Blue Streak models have a capacity of 2,500 lb. and the Red Streak models, 3,500 lb.

Yale Red Streak hand-lift truck

Special-Purpose Welding Electrodes

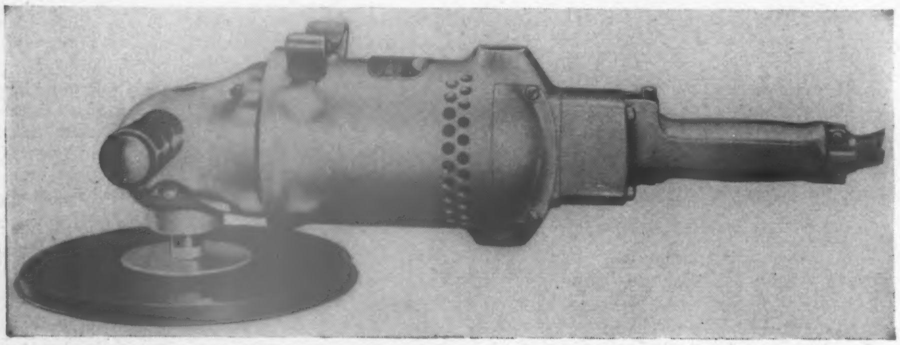
Two electrodes of special composition are among the recent developments of the Lincoln Electric Co., Cleveland, Ohio. One is a special electrode for reclaiming worn parts. Known as Hardweld 50, it is lightly coated and of reversed polarity for building up dense, tough, medium-carbon deposits which resist deformation and wear and which are machineable at slow speed. On straight carbon steel, if allowed to cool naturally, the deposit has a hardness of 20 to 35 Rockwell C. Hardness may be increased by water-quenching from approximately 1,500 deg. F. Hardweld 50 is made in $\frac{3}{16}$-in. and $\frac{1}{4}$-in. rods 14 in. long.

The other new electrode is Stainweld D, made particularly for work in 25-20 stain-

less steels and for surfacing worn parts to resist corrosion and impact. It is useful for welding steels which are air hardening and which cannot be heat treated after welding. The electrode produces an exceptionally smooth bead with corrosion resistance equal to or greater than that of the parent metal. Tensile strength is 80,000 lb. to 90,000 lb. per sq. in. with ductility of 35 per cent to 45 per cent elongation in 2 in. The electrode is made in $\frac{3}{32}$-in., $\frac{1}{8}$-in., $\frac{5}{32}$-in., $\frac{3}{16}$-in. and $\frac{1}{4}$-in. sizes, $11\frac{1}{2}$ in. long.

Heavy Duty Production Sanders

Heavy duty production sanders for use with 9-in. abrasive discs have been developed by The Black & Decker Mfg. Co., Towson, Md. The standard motor which operates on 110 volts runs at a no load spindle speed of 5,000 r. p. m. It is equipped with a spindle lock which facilitates quick changing of the disc. It is fully equipped with ball bearings and the bearings are grease sealed against dust and dirt. The switch and commutator are also sealed. The disc is driven through spiral bevel gears. The motor is ventilated with a pusher type steel fan which forces straight-line ventilation through ample vent slots.



The Black & Decker 9-in. heavy sander

This machine is suitable for continuous high-speed production metal finishing; grinding metal, stone, or tile surfaces with saucer wheels; removing scale, rust and paint with a wire brush, and shaping wood surfaces with planer heads. Smaller and lighter machines of similar design are also available where production and maintenance work calls for intermittent use of the sander rather than continuous high-duty performance.

Cincinnati Hydraulic Universal Grinder

A line of universal grinding machines, built in 14-in., 16-in. and 18-in. swings, and 36-in., 48-in. and 72-in. between-center lengths for each swing, have recently been announced by Cincinnati Grinders Incorporated, Cincinnati, Ohio.

The table is powered hydraulically, having infinitely variable traverse rates of 3 in. to 220 in. per minute. The power table stroke may be set as short as $\frac{3}{32}$ in., simulating the action obtained from a reciprocating grinding-wheel spindle. Accuracy of automatic reversal is within .004-in., allowing the operator to power grind exceptionally close to shoulders without fear of spoiling the work. The hand table traverse has two speeds (mechanically controlled)—$\frac{1}{10}$ in. per turn of the handwheel for close adjustment and grinding shoulders; $\frac{15}{16}$ in. per turn for setting up. Hand servo power control may be obtained as an extra. This feature is useful when the operator must frequently traverse the table by hand.

Filmatic bearings are used for the main grinding-wheel spindle. Each bearing consists of five heavy steel segments or shoes with bronze lining next to the spindle. These shoes are constructed to create wedge shaped oil films, and are self-adjusting for variations in load produced by the variety of grinding cuts encountered with universal machines. A plain bronze thrust bearing, self-adjusting for wear, is located midway between the ends of the spindle. Oil under a definite pressure completely fills the bearing compartment. The spindle can not rotate until this pressure is attained, and conversely, the spindle drive motor automatically stops if the oil supply should fail or diminish.

The wheel head may be swiveled 90 deg. right and left. Mounted directly on top of the wheel head unit, a 5-hp. motor drives the grinding wheel spindle through V-belts.

A hinge-type bracket at the front of the wheel head contains the internal grinding

Graduations on the cross-feed handwheel facilitate hand adjustments

quill and spindle. The attachment is always in place, yet completely out of the way for any job within the capacity of the machine. It may be quickly set up by swinging it down and tightening only one bolt.

The headstock incorporates a new type of drive known as the Speed Ranger. By merely turning a handwheel at the front of the unit, an infinite number of speeds may be selected, ranging from 25 to 225 r.p.m. If desired, an optional range of 40 to 360 r.p.m. may be obtained. Graduations on the base of the unit are for a swivel range of 90 deg. forward and 30 deg. to the rear. Like the hand table traverse, hand cross traverse has a two-speed arrangement; .050 in. per turn of the handwheel in low gear and .25 in. per turn in high gear. The graduations on the rim behind the handwheel constitute a convenient innovation in grinding machine controls, especially for repetitive multiple diameter work. Diameter reduction as small as .0001 in. may be obtained by hand adjustment. Automatic pick feed may be set for one to seven notches on the cross-feed handwheel, reducing the work diameter .0004 in. to .014 in.

Lubrication is principally automatic. Table ways are protected with telescopic guards, and are pressure lubricated with filtered oil from an individual reservoir. The grinding wheel spindle bearings are

Cincinnati 16-in. by 72-in. hydraulic universal grinder—These machines are also made in 36-in. and 48-in. between-center lengths

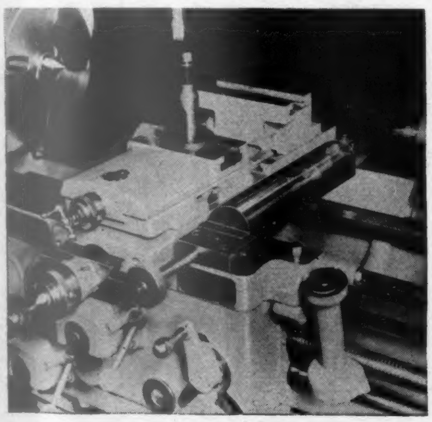
also lubricated with filtered oil from an individual reservoir. The same can be said of the hydraulic system, while the headstock unit has automatic splash lubrication.

All controls, including the electrical push buttons, are closely grouped, for operating convenience. To further reduce fatigue, the work rotation and coolant flow automatically start and stop with the table traverse start-stop lever. Independent controls are also provided for incidental work which does not require coolant.

Net weights vary from 7,600 lb. for the 14-in. by 36-in. machine to 10,000 lb. for the 18-in. by 72-in. machine. Motors and controls are included in these weights.

Multiple-Stop Lathe Attachments

Multiple-stop lathe attachments applicable both to the longitudinal and cross feeds of the cutting tool have been developed by the Reed-Prentice Corporation, Worcester, Mass. These attachments are designed for installation on engine lathes, thereby adapting the lathe to a considerable range of production work on a semi-automatic basis. The new multiple stops

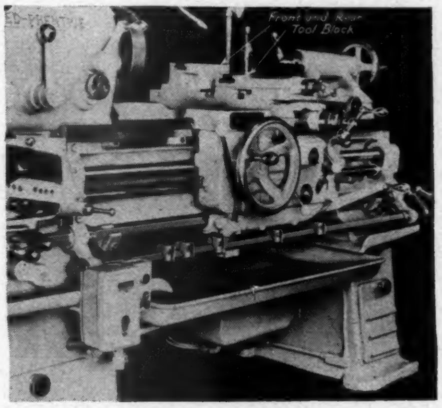


Adjustable multiple cross stops applied to a Reed-Prentice engine lathe

are available for Reed-Prentice 14-in., 16-in., and 20-in. engine lathes.

One of the illustrations shows the application of automatic multiple length stops which permit accurately duplicating shoulder lengths on repetition work. The sliding bar mounted at the front of the lathe carries a number of adjustable stop dogs. A stop handle carried on the apron engages the dogs in turn, moving the bar and disengaging the feed. A touch on the stop handle releases the dog, the rod slides back into position, and the feed is automatically re-engaged. The stop handle moves forward ready to contact the succeeding stop dog for the next shoulder length.

The adjustable multiple cross stops shown in the other illustration permit accurately duplicating diameters on repetition work. This device consists of a rod mounted in brackets across the carriage wings carrying a stop block in which are six adjustable stops. The stop block slides on the cross rod on which it is securely clamped. The stops are adjustable for the series of diameters required and may be rotated, by means of a knurled knob at the



Application of automatic multiple length stops on an engine lathe

front, into position for contacting the hardened stop dog attached to the compound-rest cross slide. After rotation, the rod is retained in position by a spring plunger.

It will be noted that the carriage is fitted with both front and rear tool blocks. These permit a variety of tooling for speeding up production operations.

Flat Surface Grinder

A complete revision in the design of its flat surface grinding machine has been made by the Diamond Machine Company of Philadelphia, Philadelphia, Pa. The bed has been lengthened, the platen is wider, the table is hydraulically driven, and throughout the machine provisions have been made for the protection of all bearing surfaces against grit and spray.

The bed is 229 in. long by 48½ in. wide and at the extreme limits of travel the platen never overhangs. The distance between the ways has been more than doubled, providing a wider foundation for the table, which rides on precision-machined ways, one flat and the other a 90-deg. V. The latter is inclined off the vertical to take up side thrust and equalize pressure on both ways. The width of the platen has been increased to 36 in. This facilitates the grinding of wider parts and allows more room for mounting the magnetic chuck.

Another of the outstanding features of this machine is the patented Fluid-Tension table drive. This consists essentially of two hydraulic pistons, the rods of which are always in tension, and is designed to provide uniform table speeds in both directions of travel. The pistons are actuated by fluid pressure from a variable-stroke reversible Hele-Shaw pump. The maximum table speed is 100 ft. per min. The table travel can be controlled manually by a hand lever or automatically by the setting of the table dogs.

The main spindle is driven by an electric motor through V-belts. The V-belt pulley is located at the end of the spindle for ease of checking and installing belts. The spindle housing, motor, and V-belt drive are protected by rigid metal covers.

The spindles run in Timken roller bearings in a circulating lubricating oil system. The 36-in. wheel operates at 440 r. p. m.; the 30-in. wheel at 530 r. p. m.

The wheel head is designed so that it may be rotated horizontally as much as 15 deg. to permit concave grinding. This machine is normally furnished with a hand operated cross feed of the wheel. Automatic feed can be furnished if desired, however.

A star wheel dresser is attached permanently to the upper wheel guard. It may be operated by a remotely controlled hydraulic wheel-truing device while the machine is in operation.

An automatic force-feed oil system lubricates the table ways. A valve enables the operator to force oil on the table ways be-

Diamond face grinder with long bed and wide platen

fore the machine is started. A centralized system, manually operated, provides oil for the feed-screw nut, wheel-head ways, and reversing-dog gear-train bearings. The Timken tapered roller bearings of the main spindle are lubricated by a circulating system.

Another feature to which particular attention was devoted in the design of this machine is the location of the controls. These are all brought together near the angle between the bed and the wheel head. Here are located the table and wheelhead controls, the start and stop push buttons for both spindle and table motors, the coolant valve, control of the wheel-truing device, and the filling points for the hydraulic system and the spindle-lubricating system.

The 30-in. machine accepts work 17½ in. in height by 84 in. long with the front guard in place. With the guard removed it will take work up to 23½ in. high. The 36-in. machine, with the guard in place, will take work up to 23½ in. high by 84 in. long, and the height can be increased to 29½ in. by removing the guard.

Portable Locomotive Air-Operated Jack

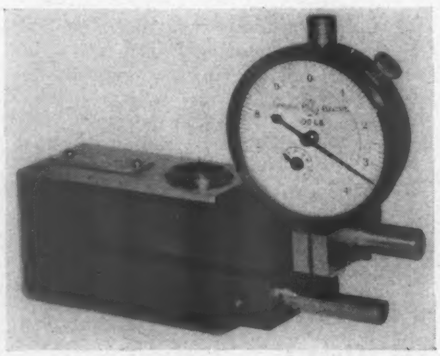
In keeping with the requirements for efficiently servicing the new and heavy Diesel-powered locomotives, The Joyce-Cridland Co., Dayton, Ohio, has built a model of the Joyce air-operated jack. This jack is available in 75- and 100-ton capacities, with an overall height of 44 in. and a lift of 30 in.

All models of the 50-, 75- and 100-ton capacity jacks may be equipped with either piston or rotary air motors. The locomotive jack is mounted on pneumatic rubber tires for portability and has drop handles at the sides for use in placing it under the load.

Joyce piston-type air-motor jack

An Electrode Pressure Gage

An electrode pressure gage designed to measure the pressure between the electrodes of resistance-welding machines has been announced by the General Electric Company, Schenectady, New York. The gage is for use either as a standard for checking existing gages or pressure indicators on spot, line, or projection welders, or for checking the electrode pressure at the time of set-up, before proceeding with production work. It also may be used by testing laboratories for pressure determinations, or by industrials interested in checking the pressure of various kinds of springs in compression.



General-Electric electrode pressure gage

The new gage measures pressures from 0 to 4,500 lb.; an automatic stop safeguards it against damage, should pressures of more than 4,500 lb. be applied. Consisting simply of a calibrated steel yoke and a micrometer dial indicator, the gage is easily applicable to existing resistance welding machines without the need for jigs or other auxiliaries.

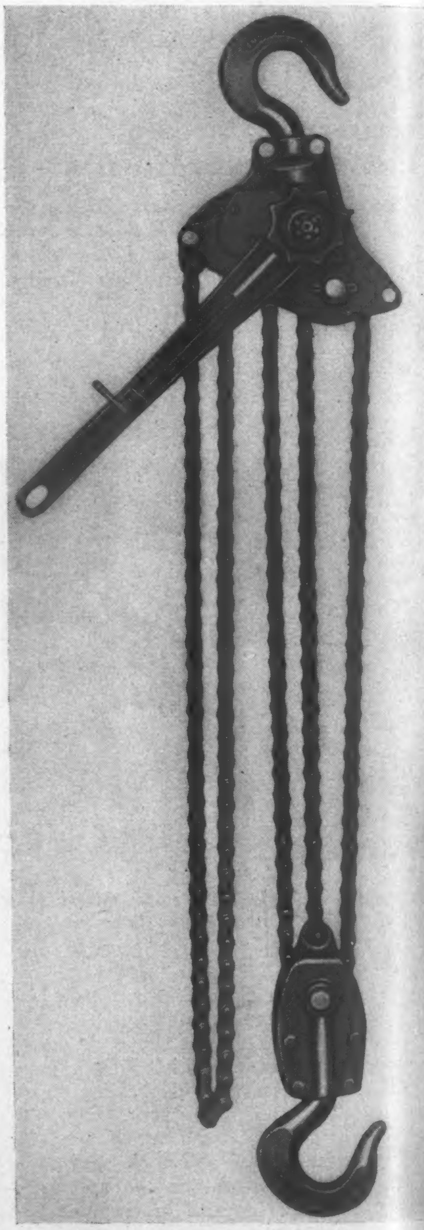
When electrode pressures are to be measured preliminary to production work, the gage is inserted between the electrodes so that they press on the pads on the top and bottom of the gage yoke. The electrode pressure is adjusted until the desired pressure is registered on the gage dial. The gage is then withdrawn and the welding machine placed in operation.

The dial indicator is direct reading; no calibration curves or multipliers are necessary. It has two scales, one for reading in 10 lb. intervals up to 1,000 lb., and the other to read in 1,000-lb. intervals. Each gage is carefully calibrated at the factory before shipment.

Four and One-Half-Ton Portable Hoist

The Yale & Towne Manufacturing Company, Philadelphia, Pa., has added a hoist with a capacity of 4½ tons to its line of Pul-Lift portable hoists, so that now Pul-Lifts may be had in a complete range from ¾- to 6-ton capacities. The intermediate sizes have capacities of 1½, 3 and 4½ tons.

The 4½-ton hoist has the same safety and construction features as the previous models. It is about 75 per cent lighter than conventional equipment, making it easily portable. The great strength combined with the lightness of weight is due to the use of alloy steels.



The Yale 4½-ton Pul-lift portable hoist

This hoist will operate equally well in horizontal or vertical position. Thus it can be used for both pulling and lifting and is ideal for almost any type of main-

tenance job. It also has Yale safety hooks. In case of severe overload, these hooks open slowly, without fracture, giving ample visual warning of danger.

For operation in close quarters and tight out-of-the-way places, the Pul-Lift has a ratchet handle with a universal action. Short, easy strokes at any point within a complete circle permit operation in the most cramped of quarters. Possibility of flying handle is decreased to a minimum by the self-actuated load brake. As the load is increased, brake pressure increases in direct proportion.

Forging Machine Die Support

Some years ago the Ajax Manufacturing Company, Cleveland, Ohio, introduced a direct-acting air clutch in the drive of its forging machines. A recent development in this clutch is the inclusion in it of double-draft air ventilation. This provides a generous circulation of air and ample cooling throughout the clutch. It is designed to prevent overheating at the highest frequency of engagement and prolongs the life of the friction surfaces. The air enters the clutch through scoops on both sides of the flywheel hub. It is forced through the clearance between the clutch plates and out inside of the flywheel rim.

Another feature of recent development in these machines is a top-suspended outboard-guided die slide, now standard on 3-in. and larger machines. The great overall bearing length which results from the use of an outboard guide bearing located at the extreme right side of the bed frame overcomes the tendency toward cocking either horizontally or vertically and maintains the moving die in perfect match with the stationary die under the spreading pressures during heading.

The shuttle-support plate prevents the moving die from rocking under heading pressure where its backing plate support is, of necessity, cut away at the feed gap. This rugged construction successfully overcomes an inherent difficulty, particularly on large machines, and permits opening up the feed gap without loss of die alignment. When in its closed position overhanging the feed gap and supporting the moving die against heading pressure, it is held positively square against the backing plate by a retaining cap at its extreme end, anchored by four through bolts directly to the bed frame.

The outboard die slide support bearing is protected by shrouding ribs at both sides

The main portion of the slide is suspended from two long, wide lips faced with alloy-bronze bearings operating on hardened and ground steel shelf liners in the frame. These liners are full length to provide full support for the die slide throughout its entire stroke and are elevated so as to be free from the accumulation of scale and water.

A strong intermediate underarm joins the main slide body and the outboard guide bearing. The outboard bearing at the end of the underarm is located at the extreme right of the machine bed and is completely framed with heavy ribbing. The single wide and long support liner of the outboard bearing extends well toward the center of the machine and is protected from the entrance of foreign matter by shrouding ribs projecting downward from the arm at both sides of the bearing. Thus, the die slide has three points of support with the moving die carried between the bearings in such a manner as to prevent sagging and to maintain its face square with that of the stationary die.

The bed frame is completely lined where the die slide and shuttle support plate operate and also at the stationary die seat with heavy steel liners for protection against localized wear or peening

Double-End Wet Grinders

Recent developments of the Standard Electrical Tool Company, Cincinnati, Ohio, are two lines of double-end wet grinders, one to accommodate grinding wheels 12 in. to 18 in. in diameter, the other for 10-in. to 14-in. cup wheels.

The motor sizes of the plain-wheel machines are 2 hp. to 5 hp. for operating the grinding wheels, while equipment also includes a motor-driven pump suitably mounted on the machine. The push-button starter at the front of the grinder simultaneously operates both the grinder motor and the pump motor.

Standard double-end wet grinder

Suitable hoods with integral splash bowl are furnished complete with piping for carrying water to the wheel, and a valve

to control the flow of water. The water returns by gravity to a tank. The pump has a capacity of 10 gals. per min. This

Double-end cup-wheel grinders with wet grinding attachment

machine can also be arranged as a combination wet and dry grinder if preferred.

The double-end cup-wheel grinders serve the demand for suitable grinding equipment for high-speed tool bits such as Ramet metal, Tungsten carbide, etc. The machine is made in 1-, 2-, and 3-hp. sizes, with cup wheels 10 in., 12 in., and 14 in. in diameter, respectively. Adjustable hoods compensate for wheel wear.

A graduated table permits grinding from a 30-deg. angle toward the wheel to a 45-deg. angle away from the wheel. The table extends to permit periphery grinding. It is adjustable to wheel wear and also may be raised or lowered. Equipment includes a reversing switch.

A motor-driven pump is conveniently located on the machine with a separate switch for operating the pump motor. An adjustable valve controls the flow of water for each wheel, with suitable splash bowl attached with piping for gravity return of the water. The pump has a capacity of 10 gals. per min.

A set of four high lift electric jacks being used to lift a locomotive tender for the removal of trucks—These jacks are controlled electrically by single control

High Lift Portable Electric Jacks

One of the recent developments of the Whiting Corporation, Harvey, Ill., is the high lift, electric, portable jack which is now being used in car and locomotive shops and engine terminals for a variety of lifting jobs. These jacks are built in capacities of 20, 25 and 35 tons each. Since they are used in pairs these figures are doubled. The 20- and 25-ton models are used principally for coaches and most Diesel switchers, while the 35-ton models are for heavier work such as the Diesel-electric passenger and freight locomotives. The standard models have a hoisting speed of 9 in. per min., a low position of 2 ft. 7 in. and an effective lift of 3 ft. 11 in.

The Whiting high-lift electric portable jack is mounted on four wheels, two large rear wheels that take most of the load when the machine is being moved, and two small pivoted wheels in front for steering. These wheels form a substantial three-point support. The lifting screw supports the movable bracket used to raise and lower the load. The bracket is braced by a top roller support at the front of the machine and a bottom roller at the rear.

The base of the jack has a projecting foot which extends under the coach or locomotive a greater distance than the bracket that supports the load. For this

A high lift jack installation in a repair yard where car work is done

reason, and because of the width of the base, a safe footing is provided during raising operations.

A forked crank located near the base of the screw is brought into action when the lifting bracket reaches the lower extremity of its travel. The bracket presses the fork down, thereby forcing the two large rear wheels onto the ground and raising the toe of the base an inch above the ground, so the jack rests on the wheels. This permits the jack to be pulled along the ground to any location. When the jack is in position for lifting, the bracket is raised by the rotation of the screw, thereby disengaging the fork and freeing the wheels, so that the jack rests on its base. Any small strain adjacent to the small front wheels is absorbed by two helical springs located in a vertical position above the wheels.

Each jack is equipped with an electric motor and silent chain drive which operates the worm gearing for rotating the screw. The lifting bracket rests on a bronze jack nut through which the hoist screw passes. This nut moves up and down, depending on the direction of rotation of the hoist screw, and carries the bracket with it.

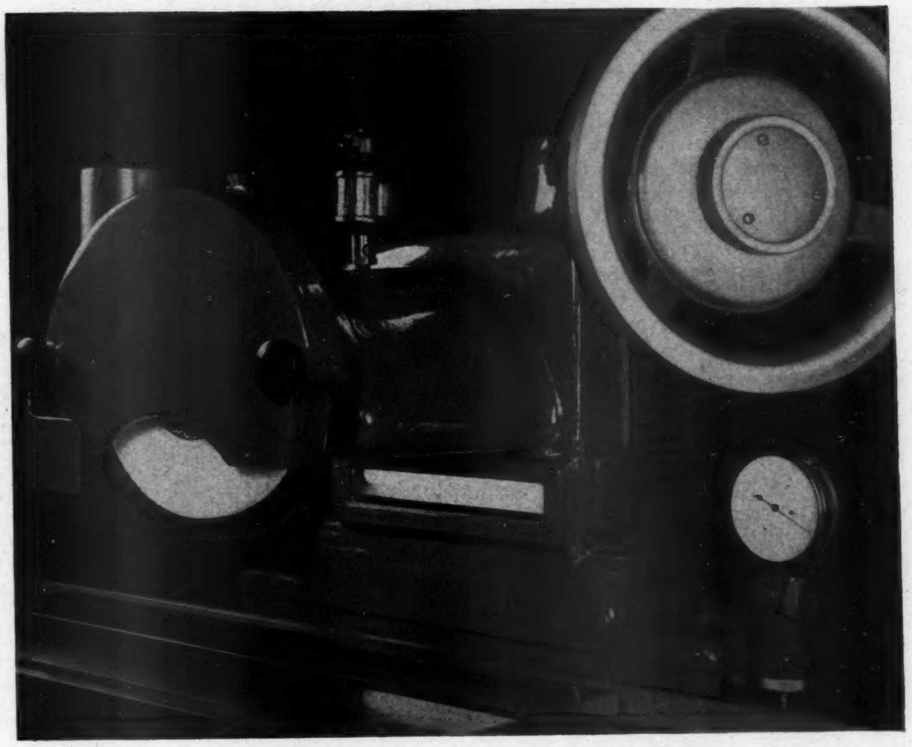
Top and bottom limit switches automatically cut out the motor for high and low limits of travel. A master control permits the operation of two or four jacks at one time from one push button station.

From a single push button control station, the operator can raise or lower any individual jack, one pair of jacks, or four jacks in unison. By using electric power, uniform speed is obtained in raising and lowering all jacks.

When the lifting bracket is in its lowest position, the base of the jack then rests on two large rear wheels and a small pair of pivoted wheels loated in front, used for steering. Thus supported, the jack can be wheeled to any location by means of a handle attached to the jack at a point between the two small pivoted wheels. The wheels are equipped with roller bearings, making it possible for one man to move the jack.

To lift one end of a car or Diesel-electric locomotive, two jacks are rolled to the vehicle—one on each side—and located usually at the ends of the bolsters. The power cable is plugged in and each jack operated separately until its lifting bracket is bearing against the jacking pad at the side sill and is taking the load. The jacks are then so connected electrically that both operate as one, and their brackets are made to elevate as one, raising the body high enough to allow the trucks to be rolled out. If other trucks are to be applied at once, the cars can rest on the jacks, since it is safer there than on the usual types of car supports.

The same course is followed when four jacks are used for raising cars, locomotives or tenders. After the load has been raised, other means may be used for supporting the load, thereby releasing the jacks for other work. The jacks may then be lowered to the point where their bases are automatically raised from the ground, placing the weight of each jack on the wheels. This allows the jacks to be pulled elsewhere for work on other equipment.



The spindle head of the Doall precision surface grinder

Precision Grinder Has Many Conveniences

In the spindle-head assembly of the new Doall precision surface grinder are several exclusive features, such as built-in flush lighting, directed where it is needed; dial indicator giving direct measurement between wheel and work in tenths; and an adjustable dust or splash guard which can be set close to the work and adjusted as the wheel wears. Precision ball bearings carried in a heat-treated forged and ground S. A. E. 3140 quill make up the heart of this assembly.

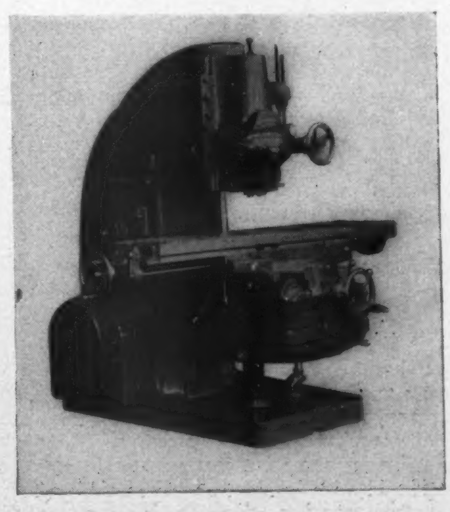
The wheel guard rotates and can be locked in any position when using a tangent-to-radius wheel dresser. The handwheel is graduated in half thousandths and has an auxiliary vernier adjustment for feeding in tenths. The handwheel is furnished in dull chrome with enamel-filled graduations to insure against rust from perspiration or coolant. The dull chrome finish also makes an ideal surface on which to mark settings with a lead pencil.

The machine is the product of Continental Machines, Inc., Minneapolis, Minn.

Improved Designs of Milling Machines

Among the recent additions to the line of Milwaukee milling machines manufactured by Kearney & Trecker Corporation, Milwaukee, Wis., are the Nos. 4K and 5H series of plain, universal and vertical machines.

The No. 4K machines are heavy-duty models, having increased range, improved controls, hydraulicly actuated starting levers which are duplicated for the front and rear, pressure lubrication and structural refinements. The working surface of the table is 82 in. by 18 in. Longitudinal power feed of 42 in. is supplied, together with 14 in. of power feed for the cross movement and 20 in. for the vertical. Twenty-four speeds are provided between 13 and 1,300 r. p. m. Rotation of the spindle is provided either forward or reverse under the control of a directional lever. Thirty-two feeds are available in a longitudinal and cross range of ¼ in. to 60 in. per min. at a vertical rate of ⅛ in. to 30 in. per min. A rapid traverse of 150 in. per min. for longitudinal and cross rate and 75 in. per min. for the vertical range is standard on these machines. These machines are powered with 15-hp. or 20-hp. motors.



One of the improved type Milwaukee horizontal millers

Designed on the same principles of the 4K machines the No. 5H models have in-

creased working range of the table. The working surface over all is 94 in. by 18 in. Power feed ranges are provided as follows: longitudinal power feed, front and rear control 52 in.; cross power feed, front and rear control 16 in.; and vertical power feed, front and rear control 20 in. The horizontal types of Model H machines are nearly 71 in. high, while the vertical model is 89 in. high. The double overarms on horizontal machines consist of two solid steel bars each 5¾ in. diameter. There are twenty-four speeds ranging from 13 to 1,300 r. p. m. and 32 feeds in the longitudinal and cross ranges from 1.4 in. to 60 in. per min. at a vertical rate of ⅛ in. to 30 in. per min. Lubrication for the column and knee, and for the dividing head on vertical machines, is taken care of by individual oil pumps located in these respective parts.

Flue Cleaner Requires No Air

A simplified flue cleaning machine known as the Ryerson-American-Wheelabrator is now available through Joseph T. Ryerson & Son, Inc., Chicago. It is a fast cleaning unit requiring no air pressure, thereby eliminating the most costly factor in operating blasting equipment. Essentially the machine consists of an enclosed cabinet, an abrasive throwing unit, an abrasive cycling system, and a conveyor to carry the flues through the blast.

The blasting unit consists of a bladed wheel revolving at high speed to throw metallic abrasive against the work at the most advantageous cleaning angle. After being expelled against the boiler flues, the abrasive is cycled through the machine to a hopper, directly above for subsequent return to the unit.

Flues are carried through the blast on dished, skewed-roll conveyors which rotate the flues and advance them through the blast at a controlled rate of speed. The conveyor is equipped with a variable-speed drive so that the speed of travel through the blast can be varied according to the scale condition on the tubes. Under a normal scale condition, the flues are cleaned at a speed of approximately 20 to 30 ft. per min., at which the average length of boiler flue can be cleaned in less than one minute. The simplicity of the cleaning method and the speed of cleaning is said to make it possible for each boiler flue to be kept in good condition at low cost.

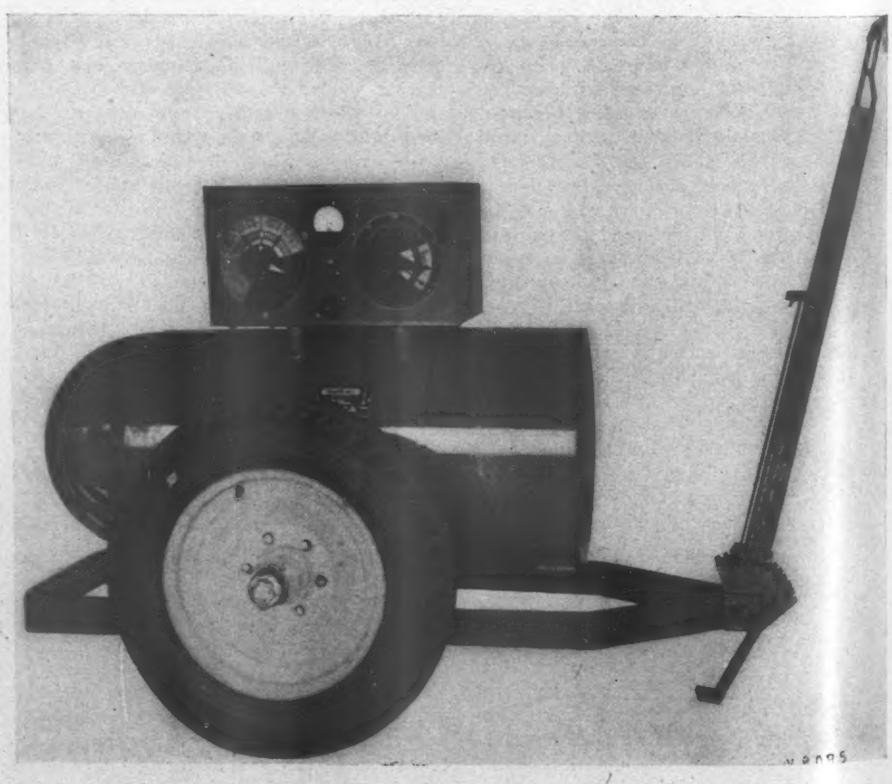
The new machine is furnished complete with necessary exhaust fan, dust cleaning units, dust bags and power shakers.

Flues are cleaned with metallic abrasive at a speed of 20 to 30 ft. per min.

A Portable Electric Welder

The photograph shows a two-wheel, lightweight pneumatic-tired trailer for mounting arc-welding machines to permit easy, fast portability in the shop or yard which has recently been introduced by the Lincoln Electric Company, Cleveland, Ohio.

Designed for mounting either Lincoln S. A. E. 200- to 600-ampere a.c. motor-driven or type SA-200 special engine-driven arc welders, the new unit can be hitched to an industrial truck or moved readily by hand by virtue of its low underslung construction, narrow 31-in. tread and method of balancing. Mounting is readily accomplished by means of four bolts in the frame of the trailer which register with holes in lugs on the welding machine. A hand-operated ratchet arrangement for locking the support arm in position is provided in the combination tow bar and standing support.



Light two-wheel trailer for Lincoln welder

(*Turn to next left-hand page*)

How to get the
MAXIMUM SERVICE LIFE
from your
CHILLED CAR
WHEELS
WHEEL SHOP PRACTICE
ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
CHICAGO NEW YORK
CONTENTS
CHAPTER I
MACHINING OF WHEELS
CHAPTER II
MACHINING OF AXLES
CHAPTER IV
WHEEL PRESS OPERATIONS
CHAPTER V
CHECKING AND CORRECTING EQUIPMENT
Based on data compiled from visits to more than 250 wheel shops and the cooperation of 87 others in answering questions concerning mounting of both new and second hand wheels, this manual of wheel shop practice will help your men do a better job . . . thereby increasing service life of both axles and wheels.
Copies of "Wheel Shop Practice" may be obtained without cost from our Chicago office. Every wheel shop foreman needs one.
ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
230 PARK AVENUE, NEW YORK, N. Y.
445 N. SACRAMENTO BLVD., CHICAGO, ILL.
AMCCW
ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

High Spots in
Railway Affairs . . .

St. Lawrence Project

The Administration is apparently determined to have its way with the St. Lawrence seaway and power project. The latest movement, made at the request of President Roosevelt, is to include it in the Rivers and Harbors Bill. The President, in asking that this procedure be followed, said, "You know how I had counted upon getting the St. Lawrence project started this year, in order to get power as soon as possible for the defense program. I have come to the conclusion that the best way to expedite the matter is to include it as one of the projects in the Rivers and Harbors Bill." Dr. Julius H. Parmelee, director of the Bureau of Railway Economics of the Association of American Railroads, told the House Rivers and Harbors Committee that, "If the project was completed, railroad revenues would decline at least $105,000,000 a year, due to direct diversion of traffic to the waterway and to the drop in coal tonnage shipped by rail." J. G. Luhrsen, executive secretary of the Railway Labor Executives Association, advised the committee that the project has "every element of preponderance of evil, rather than good, for the American people as a whole."

Transport Board Confirmed

The Transportation Act of 1940 provided for the appointment by the President of a Transport Board to study and report on the various types of transportation with a view to using them in such a combination as to develop an adequate national transportation system. The President named a board on March 20. The Senate was not impressed by the personnel and took no action. On April 29 the President withdrew the name of Wayne Coy, and again, on July 24, that of Charles West, but leaving for consideration by the Senate the name of Nelson Lee Smith, chairman of the New Hampshire Public Service Commission. At the same time he nominated C. E. Childe of Omaha, Neb., and Robert E. Webb, chairman of the Kentucky Railroad Commission. These nominations were confirmed by the Senate on August 11. While Messrs. Smith and Webb have had no experience on the practical side of transportation, they have served several years each on their respective state commissions, and have the reputation of being hard workers and conscientious public servants. Smith got his start as a college teacher of economics and Webb as a lawyer. C. E. Childe started on the Chicago, Burlington & Quincy as a station helper, telegraph operator and clerk. Later he was accociated with the traffic bureaus of the Chambers of Commerce of Omaha and Sioux City. He has been active in the National Industrial Traffic League, serving at one time as its president. Since 1934 he has been engaged in private practice as a transportation counsel. For many years, however, he has been closely identified with the inland waterway interests. Senator Reed, of Kansas, opposed his confirmation strongly because "he has been a traffic adviser and lobbyist for inland waterway interests and has shown bias and prejudice in hearings before our committee, which are of record."

Continuous Welded Rail

In a paper before the Metropolitan Maintenance of Way Club, P. O. Ferris, chief engineer, Delaware & Hudson, reviewed the experience of that road with continuous welded rail. The first installations were made seven years ago. Among other advantages it reduces the cost of track maintenance, lengthens the life of the rail, eliminates the necessity of bonding joints and makes for better conductivity in track circuits, insures smoother riding track and lowers the cost of maintaining alinement and surface.

Wheat Movement

The railroads have been disappointed at the amount of wheat movement they have been asked to handle. They have had ample cars available, but the storage facilities throughout the country are jammed with the carry-over from last year's harvest and this year's early crop. The Car Service Division, therefore, has been forced to place embargoes on the movement of wheat. In explaining this, in the case of the Pacific Northwest, it announced, "This is a defense measure. We cannot permit cars needed for defense traffic to be used as wheat warehouses. The normal movement of grain is not affected, as there is no ban on grain that is sold and can be moved. The government is in full accord with the plan and the northwest mills and grain interests have requested the embargo." The wheat crop in the state of Washington is double its normal size; at one of the wheat growing centers in the state, Lind, it is said there are more than 100,000 bushels of wheat piled on the ground because of lack of storage space.

Railroad Employees Contribution to British

As the months have passed, the movement by railway employees to raise funds for the British war relief has grown steadily and rapidly. Employees of the Central Railroad of New Jersey have provided five ambulances, the Reading Company a substantial number, the St. Louis-San Francisco two, and at present a drive is on among the employees of the Lehigh Valley to contribute one per cent of their salaries for one month. According to Mrs. W. A. Deems, assistant executive secretary, British-American Ambulance Corps, New York, the credit for the largest single donation from any one railroad goes to the Baltimore & Ohio. Its total contribution has exceeded $78,000. Of this amount $65,000 was expended for a flying ambulance, which was dedicated on May 19. In addition a home has been provided for evacuated children at St. Just, Cornwall, and 500 radio sets have been supplied for British railroad employees on duty at lonely and isolated points.

Washing Machines

What would it mean if there was a power-driven washing machine in every family in the United States? Or any one of a number of similar useful labor-saving devices? When we get caught up on the production of materials and equipment for our national defense program and war supplies, we must find ways and means of keeping our people employed, but not at the expense of the taxpayer—he will have more than he can do in settling the public debt incurred on so colossal a scale in these recent years. Yet there will be ample plant capacity and available power and materials, and skilled and semi-skilled labor to provide for the comfort and convenience of all of our people if we can make the best use of these facilities. It involves low cost production and cheap and efficient means of transportation and distribution. It would seem also to require a more even distribution of the national income. It is no simple problem, and yet American ingenuity should be able to find a reasonable solution; as a matter of fact, we have been making slow but steady progress in the right direction for several decades. It must be on another basis, however, than the building of more and more public works and the further piling up of our national debt. The best minds in America—not politicians, but statesmen, businessmen, industrialists, financiers, engineers, economists, etc., should be put to work on the task.

(*Turn to next left-hand page*)

IT WILL NEVER BE SEEN BY THE PUBLIC

. . . yet no other part will have a higher finish

The public looks at the outside and is satisfied if appearances are pleasing, but you can't fool steam. That is why all working parts of Lima locomotives are built with such careful adherence to exact dimensions and specifications. It is through such attention to detail, that Lima has earned for itself its enviable reputation as a builder of long-life, economical power . . . Power that not only looks good outside . . . but looks even better inside where it counts.

LIMA LOCOMOTIVE WORKS, INCORPORATED, LIMA, OHIO

LIMA LOCOMOTIVE WORKS INCORPORATED

NEWS

No Mechanical Division Meeting in 1942

In view of present heavy demands on the time of mechanical department officers in performing duties on their individual roads and the probability that these demands will be intensified in the ensuing months, it has been deemed expedient to eliminate the annual meeting of the Association of American Railroads, Mechanical Division, for 1942. In place thereof, there will be a meeting of the general committee and the chairmen of standing committees.

All Steel Under Full Priority Control

Steel in all its forms, including alloy steel, was placed under full priority control on August 9 in an order issued by E. R. Stettinius, Jr., director of priorities, Office of Production Management. Because the basic provision of the order is "that all defense orders must be filled ahead of non-defense orders," officers of the Association of American Railroads expect that one result will be an improvement in the situation with respect to deliveries of steel to car builders whose operations have been curtailed by shortages.

With the A-3 rating assigned them, materials for cars and locomotives qualify as defense materials at a relatively high place on the scale; anything with a rating of A-10 or higher is called a defense order. As the OPM statement put it, "defense orders include contracts or orders for the Army or Navy, for certain other government agencies, for Great Britain or any other lend-lease country, or any order to which a preference rating of A-10 or higher is assigned."

As noted above, the order places all iron and steel products under mandatory priorities; and while alloy steels are thus included, a separate order will be issued giving details of the regulations applying to alloys. A similar order putting pig iron under full control was issued August 6. The steel order contains a six-point formula providing for the acceptance of defense orders. Among other things the producers must file monthly reports with the Division of Priorities. If defense orders are rejected or delivery is delayed unreasonably, the customer may bring those matters to the attention of the Division. Effective September 1, purchase orders for steel must be accompanied by a special form (PD-73) obtainable from steel producing companies setting forth the purpose for which the ordered material will be used. The Director of Priorities may direct producers to make deliveries of steel in fulfillment of special defense needs; he may require them to modify production schedules; and he may allocate purchase orders to particular producers.

In line with the A. A. R. view mentioned at the outset, it was stated at OPM that one effect of the order was expected to be a more speedy release of plates to builders of railway equipment. In this connection OPM's Division of Production announced on August 7 that OPM Director General Knudsen had recommended to Federal Loan Administrator Jones federal financing for the construction of a 780,000-ton plate mill at the Sparrows Point, Md., plant of the Bethlehem Steel Company. Eugene G. Grace, president of Bethlehem, the announcement said, "submitted the program to OPM as a partial solution of the critical plate situation growing out of the naval and merchant ship construction programs, railroad car building, and other defense undertakings."

Meanwhile Priorities Director Stettinius has also announced a new Maintenance and Repairs Rating Plan to assure "a steady flow of maintenance and repair parts to essential industries." The plan is applicable at once to nine industries, including the railroads, and "common carrier passenger transportation by urban, suburban, and interurban electric railways." As noted in the August *Railway Mechanical Engineer*, page 329, the Office of Price Administration and Civilian Supply had previously promulgated an allocation program covering repair and maintenance materials for 26 industries including the railroads.

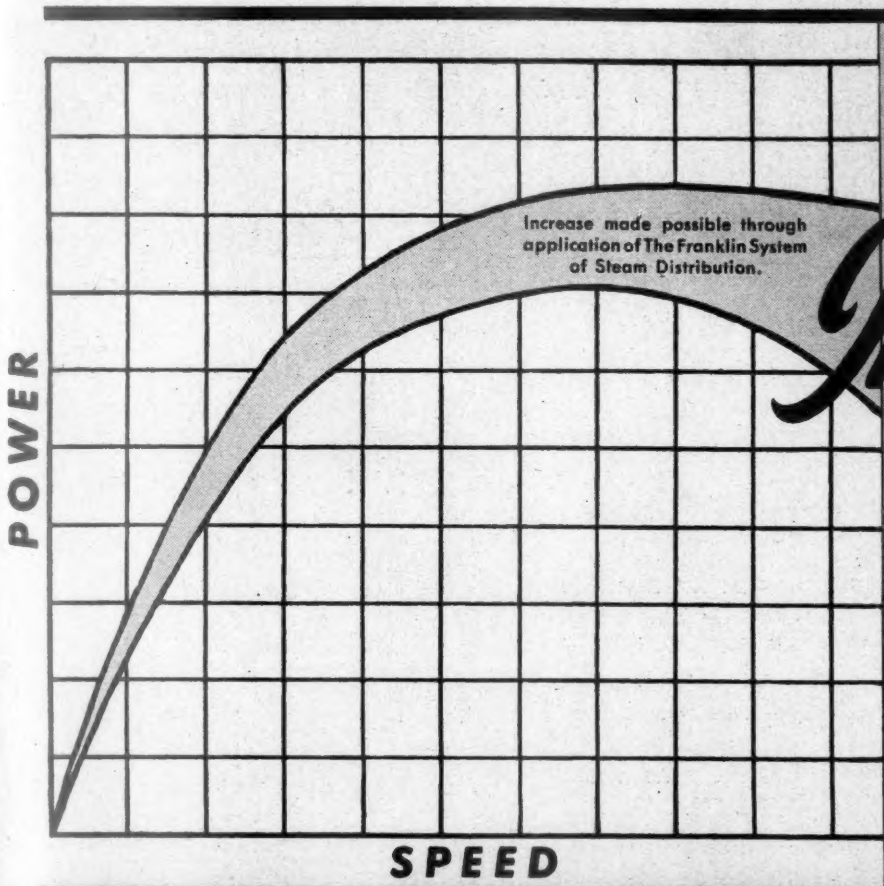
Under the OPM plan, the repair materials will get an A-10 rating, which, as noted above, is the lowest in the defense category. However, a special emergency rating of A-1-a may be assigned "in cases of extreme emergency," but only when telegraphic applications have been granted; and such applications will be granted "only in especially urgent cases, such as sudden breakdown, accident, fire or storm damage. The A-10 rating available on the repair parts will not come automatically; it must be applied for on Form PD-67. Moreover, it can be applied only to deliveries of maintenance and repair parts, and may not be used to obtain materials flowing into production, "excess" inventories of parts, or materials for plant expansion.

B.&.O. Inaugurates Diesel Service to Detroit

Following initiation and christening ceremonies, the newly equipped Ambassador train of the Baltimore & Ohio left Detroit, Mich., on July 29, on its initial run to Washington, D. C., powered with a 4,000-hp. Diesel-electric locomotive, built by the Electro-Motive Corporation, subsidiary of General Motors. This is believed to be the first use of a Diesel-electric passenger locomotive in the state of Michigan and the employment of this type of power on the Ambassador is accom-

(*Continued on next left-hand page*)

R. B. White, president of the Baltimore & Ohio, personally took delivery of the new 4,000-hp. Diesel-electric locomotive from the Electro-Motive Corporation


Increase made possible through application of The Franklin System of Steam Distribution.
POWER
SPEED

panied by a 30-min. reduction in running time between Detroit and Washington.

Preceding the dedication, a luncheon was held at the Hotel Statler, Detroit, attended by about 400, including state and city officials, representatives of the business interests of the city and executive officers of the Baltimore & Ohio, General Motors and the Electro-Motive Corporation. The two principal addresses were made by R. B. White, president, Baltimore & Ohio, and C. F. Kettering, vice-president, General Motors.

The christening exercises were conducted at the Fort St. Union Depot, where Helene Prescott, 9-year-old daughter of Frank Prescott, Electro-Motive vice-president, named the locomotive "Ambassador."

A.C.F. Turns Out 1000th Tank

The American Car and Foundry Company, on August 2, celebrated the production of its 1,000th 12-ton light combat tank with a parade and sham battle at Berwick, Pa. Fifty-five hundred employees marched in the parade which was led by the 1,000th tank dressed in white enamel. Twenty-nine fife and drum corps from Berwick and surrounding towns supplied martial music.

After the parade the tank was turned over to the Army by Charles J. Hardy, president of the American Car and Foundry Company. A sham battle was then staged at the Berwick airport field. Fifteen tanks participated in a realistic combat in which a fort and a number of pillboxes were destroyed. The car manufacturing company is now rolling off these 12-ton tanks at the rate of 14 per day, or one every 45 min. To provide facilities for manufacture of tanks, the American Car and Foundry Company financed the expansion of its plants to the extent of $3,000,000, including addition of 32 furnaces for the heat-treating of armor plate. The original order for 329 tanks was completed two weeks ahead of schedule. Total orders, including a recent one for 629, comprise 4,685 light combat tanks.

OPACS Allocation Program for Air-Conditioning Refrigerant

Allocation of available supplies of Freon refrigerant gases to users and manufacturers of civilian refrigeration and air-conditioning equipment, "including railroad cars," is directed in a program announced August 19 by the Office of Price Administration and Civilian Supply. "Heavy defense needs for this basic chemical have caused a shortage in many of its derivatives," the OPACS announcement said.

A senior classification is assigned in the program to maintenance of all types of refrigerating equipment now operating and existing air-conditioning equipment in hospitals, clinics, and sanitoria requiring Freon refrigerants. Maintenance of industrial air-conditioning equipment already installed, including that of the railroads, ranks next in preference, followed by main-

(Continued on next left-hand page)

Orders and Inquiries for New Equipment Placed Since the Closing of the August Issue

Locomotives

Road	No. of Locos.	Type of Loco.	Builder
Atchison, Topeka & Santa Fe	15[1]	5,400-hp. Diesel-elec.	Electro-Motive Corp.
Belt Ry. of Chicago[2]	1	1,000-hp. Diesel-elec.	American Loco. Co.
Central of Georgia	1	1,000-hp. Diesel-elec. sw.	Electro-Motive Corp.
	1	600-hp. Diesel-elec. sw.	
Central of New Jersey	2	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	2	600-hp. Diesel-elec.	
	4	600-hp. Diesel-elec.	Baldwin Loco. Wks.
	2	600-hp. Diesel-elec.	American Loco. Co.
Chicago, Milwaukee, St. Paul & Pacific	2	44-ton Diesel-elec. sw.	General Electric Co.
Crucible Steel Co.	1	58-ton fireless	Heisler Loco. Wks.
Louisville & Nashville	8	4,000-hp. Diesel-elec. pass.	Electro-Motive Corp.
	14	2-8-4 steam	Baldwin Loco. Wks.
Mysore Iron & Steel Works of India	1	2-8-2 steam	Baldwin Loco. Wks.
Newburg & South Shore	3	660-hp. Diesel-elec.[3]	American Loco. Co.
	1	1,000-hp. Diesel-elec.	
New York, Susquehanna & Western	2	1,000-hp. Diesel-elec.	American Loco. Co.
Norfolk & Western	10[4]	2-8-8-2 steam	Company shops
Patapsco & Black Rivers	1	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	1	660-hp. Diesel-elec.	
Pennsylvania	1	Steam-turbine-pass.	Company shops
	1	Steam freight	
Philadelphia, Bethlehem & New England	1	1,000-hp. Diesel-elec.	Electro-Motive Corp.
Richmond, Fredericksburg & Potomac	6	4-8-4 steam	Baldwin Loco. Wks.
St. Louis-San Francisco	5	1,000-hp. Diesel-elec. sw.	Baldwin Loco. Wks.
Southern Ry System:			
Southern Ry.	2	1,000-hp. Diesel-elec. sw.	Electro-Motive Corp.
	1	660-hp. Diesel-elec. sw.	American Loco. Co.
Cincinnati, New Orleans & Texas Pacific	7	1,000-hp. Diesel-elec. sw.	Electro-Motive Corp.
	3	1,000-hp. Diesel-elec. sw.	American Loco. Co.
	2	660-hp. Diesel-elec.	
Alabama Grt. Southern	3	660-hp. Diesel-elec. sw.	American Loco. Co.
New Orleans Terminal	2	1,000-hp. Diesel-elec. sw.	Electro-Motive Corp.
Terminal R. R. Assn. of St. Louis.	3	1,000-hp. Diesel-elec.	American Loco. Co.
	2	660-hp. Diesel-elec	
	3	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	2	660-hp. Diesel-elec.	
Union Pacific	25[5]	1,000-hp. Diesel-elec. sw.	Electro-Motive Corp.
Union Railroad	4	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
United States Army	1	45-ton Diesel-elec.	General Electric Co.
	2	44-ton Diesel-elec.	
Wabash	1	600-hp. Diesel-elec. sw.	Electro-Motive Corp.
	1	600-hp. Diesel-elec. sw.	Baldwin Loco. Wks.

Freight Car Orders

Road	No. of Cars	Type of Cars	Builder
Akron, Canton & Youngstown	15	70-ton covered hopper	American Car & Fdy. Co.
Atlantic Coast Line	30	50-ton auto box	Pull.-Std. Car Mfg. Co.
Burlington Refrigerator Express Co.	300	Refrigerator	Company shops
Chicago & North Western	675	50-ton box	Pull.-Std. Car Mfg. Co.
	700	50-ton box	American Car & Fdy. Co.
	250	Ore	Bethlehem Steel Co.
Chicago, St. Paul, Minneapolis & Omaha	500	50-ton box	Gen. Amer. Trans. Corp.
Cincinnati, New Orleans & Texas Pacific	2	Depressed-center flat	Company shops
Denver & Rio Grande Western	10	Caboose	Bethlehem Steel Co.
du Pont, E. I., de Nemours & Co.	100	11,000-gal. tank	American Car & Fdy. Co.
Fruit Growers Express Co.	900	Refrigerator	Company shops
Lehigh Valley	12	Cabooses	Company shops
Minneapolis, St. Paul & Sault Ste Marie	5	70-ton covered hopper	American Car & Fdy. Co.
Missouri & Arkansas	100	50-ton box	American Car & Fdy. Co.
New York, Chicago & St. Louis	250	50-ton drop-end gondolas	Greenville Steel Car Co.
	100	50-ton auto	Ralston Steel Car Co.
South African Rys. & Harbours	1,000	Gondolas	Canadian Car & Fdy.
United States Army	...	Dump cars	Western-Austin Co.
	500[6]	Tank	Gen. Amer. Trans. Corp.
	16	50-ton flat	Haffner-Thrall Car Co.
United States War Dept.	29	40-ton fire control	Greenville Steel Car Co.

Freight-Car Inquiries

Road	No. of Cars	Type of Cars	Builder
Chicago Great Western	200	50-ton merchandise	....
National Rys. of Mexico	1,000[7]	50-ton box	....

Passenger-Car Orders

Road	No. of Cars	Type of Car	Builder
Pullman Co.	6	Sleeping	Pull.-Std. Car Mfg. Co.
United States War Dept.	2	Hospital	Haffner-Thrall Car Co.

Passenger-Car Inquiries

Road	No. of Cars	Type of Car	Builder
National Rys. of Mexico	16	First-class coach	....
	64	Second-class coach	....
	40	Express-baggage	....

[1] Total estimated cost, $7,000,000. Each of the 15 locomotives will comprise four sections of 1,350-hp. each. These locomotives are in addition to five 5,400-hp. units for this road, two of which were ordered last year and are now in service, and three of which were ordered earlier this year and are now being delivered. When the additional 15 units are placed in service, the Santa Fe will have a fleet of Diesel-electric freight locomotives having a combined total of 108,000-hp.

[2] The company has also received delivery of one 600-hp. Diesel-electric locomotive from the same builder.

[3] Delivery received.

[4] These are in addition to six locomotives of the same class ordered in March but not reported in the *Railway Mechanical Engineer*. The company is now working on five Class J passenger locomotives of the 4-8-4 type, ordered in December, 1940, which it expects to complete between now and late 1941 or early 1942. The 16 Mallet engines will be turned out at the rate of about one per month thereafter.

[5] Each of the locomotives will be nearly 45-ft. long, weigh 125 tons and be equipped with one General Motors Diesel engine of twelve cylinders. Delivery is expected at the rate of six locomotives per month beginning in April, 1942. Cost of the order is estimated at about $2,000,000.

[6] Cost, $1,287,000.

[7] In addition to 1,000, order for which was noted in the August issue.

tenance of other air-conditioning equipment, then by manufacture of new refrigeration and air-conditioning equipment. "Current supplies of Freon," OPACS said, "are expected to be adequate for the maintenance of all installed refrigeration and air-conditioning equipment, but some deliveries for new units may have to be deferred until the summer ice cream and air-conditioning season is passed."

Management and Labor to Cooperate with OPM

THE railroads and railroad labor will cooperate with the Office of Production Management in meeting a shortage of skilled men in defense industries to the extent that they can do so without impairing the ability of the railroads to meet essential demands of transportation, according to a joint announcement issued on July 29 by J. J. Pelley, president of the Association of American Railroads, and B. M. Jewell, president of the Railway Employees Department of the American Federation of Labor.

Following meetings between representatives of the O. P. M., of the railroads, and of the railroad labor organizations most concerned, continues the announcement, Sidney Hillman, associate director of O. P. M., has been advised that the railroads and railroad labor will do what they can to help the general defense movement, keeping in mind their "first duty to make sure that there is no shortage of railroad transportation during this emergency."

In a statement issued after the meetings, which were held in Chicago on July 22, Ralph Budd, transportation member of the National Defense Advisory Commission, opposed the proposed transfer of some 100,000 railroad mechanics to the shipbuilding and aircraft industries. Mr. Budd's statement is elaborated in another item in this issue.

The joint statement goes on to say that Mr. Pelley and Mr. Jewell have placed the situation before the individual railroads and the local organizations of the railroad crafts affected, to determine what can be done in each individual situation toward releasing to defense industries fully skilled men, with proper protection of their employment rights on the railroads.

In discussions with the railroad representatives, continues the statement, Eli L. Oliver, representing the labor division of OPM, made it clear that there was no intention to interfere with the ability of the railroads to continue to perform their transportation work, which is looked upon by the labor division of the OPM as being as essential to the defense program as the Army and Navy. However, says the statement, Mr. Oliver stated that the prospective shortage of 1,400,000 skilled men in defense industries has made it necessary to call upon other industries, essential as well as non-essential, to help out by permitting highly skilled men to leave their service temporarily for defense work, with protection of their seniority and other employment rights.

The position taken by the railroads and the railroad employees, concludes the statement, is in keeping with their joint program of aid to national defense, adopted in June, 1940, at the very beginning of the defense movement, in anticipation of possible future shortages of skilled labor in industries manufacturing defense essentials.

R. L. Kleine Receives 50-Year Button

To mark completion of a half century of service with the Pennsylvania, Rudolph L. Kleine, assistant chief of motive power—car, with headquarters at Philadelphia, Pa., was presented with a 50-year gold button on August 18 by H. W. Jones, chief of motive power. Mr. Kleine's entire service has been spent in motive-power work and nearly all of it has been devoted to the design, construction and repairing of freight and passenger cars. After finishing his

R. L. Kleine

education at the Philadelphia Manual Training High School and at Drexel Institute, he entered the service of the Pennsylvania at Philadelphia on August 17, 1891, in the office of the superintendent of motive power of the Philadelphia, Baltimore & Washington, now the Southern General division. He was later appointed draftsman, and after being transferred to freight- and passenger-car repair work in the Wilmington (Del.) shops was promoted to foreman in 1900. He became general foreman of the Maryland division the following year, and one year later was transferred to Altoona, Pa., where he served successively as general car inspector, assistant chief car inspector and chief car inspector. He was appointed assistant chief of motive power—car, of the Pennsylvania, with headquarters in Philadelphia, on March 1, 1920.

A.A.R. Policy on Inspecting and Photographing Rail Facilities

J. J. PELLEY, president of the Association of American Railroads, has written to executives of member roads a letter answering some of the more important questions which have come up in connection with the A. A. R. circular letters of February 19 and March 26 with reference to the presence of unauthorized persons upon railroad property, the photographing of railroad facilities, and the like.

Mr. Pelley's letter, dated July 15, states that the declared policy was not intended to discourage the operation of excursions of the rail-fan type, "provided such excursions do not include inspection of vital facilities such as shops, freight terminals, docks, and the like."

With respect to inspection by the public of new passenger trains, new passenger stations and other facilities and equipment intended for public use, Mr. Pelley said "it was not the intention to suggest that there be any restrictions as to visiting facilities such as are commonly open to the public." Another question answered by Mr. Pelley was: "Is there any objection to reliable publications taking general ground views of railway installations, operations and equipment which are not of a vital nature?" His answer is: "From the proper authorities here in Washington, we are assured that there is no objection to the taking of such pictures by reliable publications. We are further advised, however, that the indiscriminate taking of photographs of railroad facilities, such as yards, shops, tunnels, bridges and other vital areas is not desirable and should not be permitted."

Railroad Mechanics Can't Be Spared Says Budd

RALPH BUDD, transportation commissioner of the National Defense Advisory Commission, believes that railroad mechanics can make their best contribution to national defense by staying in railroad shops instead of going to the shipbuilding and aircraft industries. This view was expressed by Mr. Budd after a conference of railroad officers and railroad labor leaders called by Sidney Hillman, associate director general of the Office of Production Management, on July 22 at Chicago, "to consider the integration of railroad maintenance employees into the national defense labor program."

"I have never heard of a suggestion more threatening to the transportation structure during the defense emergency," declared Mr. Budd, in commenting on Mr. Hillman's suggestion that some 100,000 of the railroads' 400,000 maintenance workers be transferred to the shipbuilding and aircraft industries. "Railroads," he continued, "not only cannot sacrifice manpower at this time but they need every available mechanical service if they are to escape being crippled."

Mr. Budd then proceeded to point out that the railroads had taken more of the transportation burden than anyone thought they could, due largely to the taking off of intercoastal and intracoastal ships and the large increase in the amount of iron ore being hauled. Moreover, said the Burlington president, the carriers are being hard-pressed because of their inability to get new cars on order due to the difficulties of the car builders in obtaining the necessary steel.

As an alternative, Mr. Budd suggested

(Continued on next left-hand page)

that it would be better to take mechanics from another field of transportation, the motor car industry, than to take them from the railroads. These mechanics, he declared, could be just as easily trained for shipbuilding and aircraft work as could the railroad mechanics, and the transfer would be much less dangerous to the welfare of the country and the defense program.

The conference, according to Mr. Budd, who did not attend, took no action of any kind, but railroad representatives were united in demanding that no attempt be made to divert their employees to any other industry at this time when railroad facilities are being taxed to the utmost.

Equipment Purchasing and Modernization Programs

Atchison, Topeka & Santa Fe.—The Santa Fe has applied to the Interstate Commerce Commission for authority to issue $20,000,000 of equipment trust certificates, Series E, to be sold through competitive bidding at not less than par and accrued dividends at a rate to be stated in the bid. Proceeds will finance in part the acquisition of equipment estimated to cost $25,000,000, including 3,975 freight cars, sixteen 5,400-h.p. Diesel-electric freight locomotives and four 1,350-h.p. Diesel-electric freight locomotive sections, and 59 lightweight passenger-train cars. The certificates will mature serially over a 10-year period—$2,000,000 on each September 10 from 1942 to 1951.

Atlantic Coast Line-Louisville & Nashville.—These roads have asked the Interstate Commerce Commission for authority to assume liability for $1,720,000 of equipment trust certificates of the Clinchfield, maturing in 10 equal annual installments of $172,000 on August 15 in each of the years from 1942 to 1951, inclusive. The proceeds will be used as part of the purchase price of new equipment costing a total of $1,917,195 and consisting of eight steam, 4-6-6-4 freight locomotives; five all-steel, 34 ft. 3 in., covered hopper cars of 70 tons capacity; and seven all-steel 29 ft. 2 in., eight-wheel caboose cars.

Chesapeake & Ohio.—The C. & O. has asked the Interstate Commerce Commission for authority to assume liability for $4,300,000 of equipment trust certificates, maturing in 10 equal annual installments of $430,000 on August 1 in each of the years from 1942 to 1951, inclusive. The proceeds of the certificates, which will bear interest at a rate not to exceed three per cent, will be used as part of the purchase price of new equipment costing a total of $5,454,190, and consisting of 1,000 50-ton, 40 ft. 6 in., all-steel box cars, and 1,000 50-ton all-steel hopper cars.

The C. & O. also plans to ask for bids for the construction of car repair facilities and additional test tracks at Newport News, Va., at estimated cost of $133,815 and for additions and alterations to warehouses at Norfolk, Va., at estimated cost of $75,000.

Denver & Rio Grande Western.—A contract amounting to $48,825 has been awarded the F. W. Miller Heating Company, Chicago, for the installation of a direct steaming system and remodeling the boiler washing system at Salt Lake City, Utah. Plans are also being made for the construction of inspection pits for streamlined Diesel-powered trains at two important terminals at an estimated cost of $54,000.

Missouri Pacific.—The Missouri Pacific has been authorized by the District court to purchase 2,850 freight cars as follows:

	For Missouri Pacific
750	50-ton, 40½-ft. box cars
250	50-ton, 50½-ft. box cars
500	70-ton hoppers
50	70-ton drop end coal cars
50	50-ton flat cars
	For Missouri-Illinois
100	50-ton box cars
50	50-ton low side flat bottom coal cars
50	55-ton covered hoppers
	For Gulf Coast Lines
250	50-ton box cars
400	50-ton low side flat bottom coal cars
50	50-ton flat cars
	For International-Great Northern
100	50-ton box cars
200	50-ton low side flat bottom coal cars
50	50-ton flat cars

Missouri-Kansas-Texas.—The M-K-T 2,000-car rehabilitation program, reported in the August issue of the *Railway Mechanical Engineer*, page 331, has been supplemented with a program calling for the rebuilding of an additional 500 box cars, the repair of 200 coal cars, the construction of 60 caboose cars and the rebuilding of 52 company fuel oil tank cars.

New York Central.—The N. Y. C. is reported to be considering the purchase of some new passenger-train cars and the overhauling of about 100 coaches.

New York, New Haven & Hartford.—Wet sand-handling equipment for steam driers at the Cedar Hill enginehouse at New Haven, Conn., has been purchased from the Ross & White Co., Chicago.

A contract has been awarded to the Foskett & Bishop Co. of New Haven, Conn., for the construction of fueling facilities for Diesel-electric locomotives at New Haven at estimated cost of $21,000.

Union Pacific.—The Truscon Steel Company, Youngstown, Ohio, has been awarded a contract for the construction of three steel buildings at the Cheyenne (Wyo.) shops, which will cost approximately $465,000 and will replace those destroyed by fire on May 19. The new buildings will consist of a 100-ft. by 176-ft. mill shop, a 96-ft. by 264-ft. wheel and tank shop, and a 40-ft. by 66-ft. grease house with basement.

"400" Diesels Completed 1,200,000 Miles

The Diesel-electric locomotives which haul the "400" of the Chicago & North Western between Chicago and Minneapolis, Minn., completed 1,200,000 miles of virtually uninterrupted service on July 1. During the 24 months that they have been in service they, with one exception, have not missed a single trip. This exception was one trip missed by one unit when it was held up for minor repairs. The locomotives were placed in operation on June 1 and 14, 1939, and since have been used on the "400" and the North Western Limited. On the "400" they operate on a schedule of 6¾ hr. for the 407 miles and on the North Western Limited on a schedule of 9¼ hr., with the result that, with the three hours in which they travel between the station and the yard at the terminals, they are in motion 19 hours out of 24 each day. On May 31, 1941, they had completed an official combined mileage of 1,144,799 miles.

Supply Trade Notes

E. J. Kunsman, formerly with the Southern Pacific at Houston, Tex., has been appointed sales engineer of the Holland Company, with headquarters at Chicago.

◆

B. F. Goodrich Company.—*L. L. Horchitz* has been appointed manager of the recently revised Los Angeles, Cal., district of the mechanical goods division of the B. F. Goodrich Company. *H. A. Shultz* has been appointed branch manager at San Francisco, to succeed *W. D. Rigdon*, who has retired, and *C. M. Christensen*, manager of the Denver, Col., district, to succeed *Max Schmidt*, who remains on that district's staff in an advisory capacity.

◆

C. W. Pearsall, manager of distributor sales of the Ahlberg Bearing Company, Chicago has been promoted to the position of general sales manager. Mr. Pearsall entered the employ of the Ahlberg organization in 1919 and since has served as a salesman in Chicago and Philadelphia, branch manager at Philadelphia and later at Chicago and then manager of distributor sales.

◆

Eugene Roth has been appointed district sales manager of the Vascoloy-Ramet Corporation, with headquarters at the company's newly opened district sales engineering office at 50 Church st., New York.

◆

A. J. Erlacher, district sales manager for the J. G. Brill Company and the A. C. F. Motors Company in Pennsylvania, western Maryland, and southern New Jersey, has had his sales territory extended to include the states of North Carolina, South Carolina, Georgia, Alabama and Florida.

JOSEPH L. BISESI, former special research associate in engineering materials for the University of Illinois, has been appointed research and test engineer of

J. L. Bisesi

the Waugh Laboratories, a division of the Waugh Equipment Company. Mr. Bisesi was born on July 29, 1901, in New York City. Upon graduation in 1923 from the University of Illinois, where he received the degree of bachelor of science in railway electrical engineering, Mr. Bisesi was employed by the New York Central as a draftsman, in which capacity he assisted in conducting tests to determine locomotive service requirements at various points on the line. He also assisted in writing specifications for electric and oil-electric locomotives and cars and in making cost studies for electrification at various points on the New York Central System. In 1926 he was engaged by Illinois Central as an electrical inspector on cars for the electrification of the Chicago terminal. In 1927 Mr. Bisesi was in charge of inspection and tests of all electrical materials on the Chicago, Rock Island and Pacific. He also assisted in the inspection of other metallic and non-metallic materials. In 1931 he returned to the University of Illinois as special research assistant in engineering materials where, as a member of the staff of the Engineering Experiment Station, he was in charge of studies on non-destructive methods of detecting flaws in steel. This was part of a study of rails conducted under the auspices of the Association of American Railroads and the Technical Committee of Steel Manufacturers. In 1938 he was promoted by the university to special research associate in engineering materials. Mr. Bisesi received the degrees of electrical engineer in 1934 and master of science in electrical engineering in 1937.

◆

BALDWIN LOCOMOTIVE WORKS.—*Curtis G. Green,* formerly with the Chicago and St. Louis, Mo., district offices of the Baldwin Locomotive Works, has been appointed manager in charge of Diesel-locomotive sales with headquarters at Eddystone, Pa. *Arthur S. Goble,* for many years connected with various sales activities of this company, has been appointed assistant manager of the Chicago district office.

SIDNEY D. WILLIAMS, formerly vice-president in charge of steel sales for the Copperweld Steel Company, has been appointed executive vice-president in charge of the company's Warren, Ohio, division.

◆

JOHN W. CONVERSE, director of personnel training for the Baldwin Locomotive Works, has been elected a member of the board of directors and executive committee of the General Steel Castings Corporation of Eddystone, Pa.

◆

T. J. FLEMING, service engineer of Manning, Maxwell & Moore, Inc., has been appointed eastern representative of the Okadee Company and the Viloco Railway Equipment Company, Chicago, with headquarters at Chicago.

◆

COPPERWELD STEEL COMPANY.—*William J. McIlvane* has been appointed general manager of sales of the Copperweld division of the Copperweld Steel Company, succeeding *Robert J. Frank.* Mr. McIlvane was formerly eastern district manager and, later, sales promotion manager. Mr. Frank will continue as a vice-president and director of the company.

◆

SAFETY CAR HEATING & LIGHTING CO., INC.—*Pearce Whetstone,* sales representative of the Safety Car Heating & Lighting Co., Inc., at Philadelphia, Pa., has been transferred to the San Francisco, Cal., office where he will serve in a similar capacity. *Howard W. Keyser,* who has been in the electrical operation department, will succeed Mr. Whetstone as sales representative at Philadelphia.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*F. A. Stevenson* has been elected senior vice-president of the American Car & Foundry Co. He will continue in charge of operations as heretofore. *W. L. Stancliffe,* formerly manager of miscellaneous sales, has been elected vice-president in charge of miscellaneous and munitions sales.

Mr. Stevenson has served his entire business career with the American Car and Foundry Company. Beginning as an apprentice at its Detroit, Mich., plant he soon was transferred, as master mechanic, to the plant at Berwick, Pa. Later he returned to Detroit as assistant general manager, and upon the abolition of the office of general manager, became assistant to William C. Dickerman, now president of the American Locomotive Company, but then vice-president in charge of operations of the American Car and Foundry Company. During World War I Mr. Stevenson was in immediate charge of all of the

Frederick A. Stevenson

company's manufacturing operations at its plants at Detroit, Mich., and Buffalo and Depew, N. Y. Later he became first assistant vice-president and then vice-president in charge of operations, with headquarters at New York. In his capacity as senior vice-president, he is now responsible for the conduct of the company's large and varied manufacturing activities, not only as a builder of railroad equipment but also as a contributing factor in the program for preparedness in the national defense. Mr. Stevenson has been a member of the company's board of directors since 1929.

* * *

All finishing operations, after heat-treating, are concentrated in this recent addition to the plant of the Greenfield Tap & Die Corporation, Greenfield, Mass.—The addition more than quadruples the company's gage-manufacturing facilities

(*Turn to second left-hand page*)


6100
GENERAL MOTORS
LOCOMOTIVES
FLEXIBILITY OF OPERATION
REDUCTION IN NUMBER OF LOCOMOTIVES
ECONOMICAL PERFORMANCE
IMPROVED TUNNEL OPERATION
GREATER OPERATING EFFICIENCY
HELPER SERVICE MINIMIZED
TRACK MAINTENANCE REDUCED
ELECTRO-MOTIVE CORPORATION
SUBSIDIARY OF GENERAL MOTORS
LA GRANGE, ILLINOIS, U. S. A.


EMC DIESELS
Matchless for
Performance
and
Economy

The St. Louis Car Company, St. Louis, Mo., is constructing three one-story brick and steel additions to its car-building plant. One building will be 232 ft. by 162 ft.; the second, 300 ft. by 240 ft., and the third, 80 ft. by 232 ft. in area.

A. Christianson has joined the staff of the O. C. Duryea Corporation as assistant to the president, with headquarters at Chicago. Mr. Christianson was formerly chief engineer of the Standard Steel Car Company and, recently, consulting engineer of the Pullman-Standard Car Manufacturing Company.

Obituary

George V. Martin, sales representative, southern territory, of the National Malleable & Steel Castings Co., died August 6 in an automobile accident. He was 67 years of age. Mr. Martin had been associated with the National Malleable & Steel Castings Company since 1904. Prior thereto he had been safety engineer with the Interstate Commerce Commission.

Edward H. Dickinson, assistant to the vice-president of sales of the American Locomotive Company, whose death July 9 was reported in the August issue of the *Railway Mechanical Engineer,* began his career in 1884 as a messenger boy in the freight office of the Lake Shore & Michigan (now New York Central). He was appointed billing clerk in 1887 and promoted to cashier in 1890. Mr. Dickinson

Edward H. Dickinson

left this railway in 1895 to enter the employ of the Brooks Locomotive Works at Dunkirk, N. Y., as assistant estimator, continuing in this capacity after that company was absorbed by the American Locomotive Company in 1901. In 1905 he was transferred to the New York office, where he served as chief clerk of the sales department until his appointment as assistant to the vice-president of sales. Mr. Dickinson was 71 years of age.

Joel S. Coffin, Jr., president and founder of the J. S. Coffin, Jr., Company of Englewood, N. J., died on August 8 of pneumonia at his summer home in Franconia, N. H. He was 50 years of age. Mr. Coffin was born in Waukesha, Wis. His father, the late Joel S. Coffin, Sr., before his death five years ago, was chairman of the board of the Franklin Railway Supply Company of New York. His brother, C. W. Floyd Coffin, is now vice-president of that company.

J. S. Coffin, Jr., graduated from Culver Military Academy and attended Stevens Institute of Technology. He entered the railway supply manufacturing business immediately thereafter and, in association with his father, organized the Franklin Railway Supply Company, Ltd., of Canada, in 1918. At the time of his death he was president of that company and had also recently formed the C.-S. Engineering Company of Englewood, a research organization for the development of railroad products. Mr. Coffin was a former director of the Lima Locomotive Works and the Franklin Railway Supply Company of New York.

Personal Mention

General

O. L. Dean, shop superintendent of the Bangor & Aroostook at Derby, Me., has been appointed acting mechanical superintendent at this point.

Ray McBrian, engineer of tests of the Denver & Rio Grande Western at Denver, Colo., has had his title changed to engineer of standards and research.

A. H. Fiedler, general master mechanic of the Northern Pacific, Eastern district, St. Paul, Minn., has had his title changed to assistant superintendent of motive power.

A. B. Childs, mechanical engineer of the Northern Pacific, has been appointed chief mechanical engineer, with headquarters as before at St. Paul, Minn.

J. B. Neish, mechanical superintendent of the Northern Pacific, has been appointed superintendent of motive power, with headquarters as before at St. Paul, Minn.

E. L. Grimm, assistant to the vice-president, operating department, on the Northern Pacific, at St. Paul, Minn., has had his title changed to general mechanical superintendent.

R. J. Matthews, mechanical assistant of the Northern Pacific at St. Paul, Minn., has been appointed assistant to the general mechanical assistant at St. Paul.

E. R. Manor, general mechanical assistant of the Northern Pacific at St. Paul, Minn., has been appointed assistant general mechanical superintendent with headquarters at St. Paul.

C. D. Love, division master mechanic of the Louisville & Nashville with headquarters at Nashville, Tenn., has been promoted to superintendent of the Louisville division at Louisville, Ky., Mr. Love was born at Knoxville, Tenn., and attended the University of Cincinnati. He entered railway service in November, 1909, as a laborer in the mechanical department of the L. & N. at Knoxville, later becoming a machinist apprentice. After completing his apprenticeship at Knoxville at Etowah, Tenn., he served as a machinist at Etowah, later being transferred to Covington, Ky. In the spring of 1919 Mr. Love was promoted to the position of assistant enginehouse foreman and several months later was transferred to DeCoursey, Ky. On February 1, 1925, he became assistant master mechanic with jurisdiction over the shops at both DeCoursey and Covington and on June 15, 1931, master mechanic at Nashville.

E. J. Kuhn, chief draftsman in the office of the chief mechanical officer of the Missouri-Kansas-Texas, has been appointed to the newly created position of mechanical engineer, with headquarters as before at Parsons, Kan.

Harry E. Hinds, assistant mechanical engineer of the Chicago, Burlington & Quincy, has been appointed mechanical engineer, with headquarters as before at Chicago.

G. L. Ernstrom, general master mechanic of the Northern Pacific, Western district, Seattle, Wash., has had his title changed to assistant superintendent of motive power.

H. W. Rasor, general foreman of the Air Line Junction (Ohio) enginehouse of the New York Central, has been appointed assistant to general superintendent of motive power, with headquarters at New York.

W. G. Knight, mechanical superintendent of the Bangor & Aroostook at Derby, Me., who holds a commission as Colonel in the Officers Reserve Corps, United States Army, has been called to active service with his regiment, and assigned to duty in the First Corps Area at Boston, Mass.

L. W. SHIRLEY, master mechanic of the Northwestern district of the Union Pacific at Portland, Ore., has been appointed to fill the newly created position of superintendent of motive power and machinery of the Northwest district, with headquarters at Albina (Portland), Ore. Mr. Shirley succeeds to a portion of the duties of L. L. Hoeffel, superintendent of motive power and machinery of the Western district, who continues as superintendent of motive power and machinery of the South-Central district, with headquarters as before at Pocatello, Idaho.

SAMUEL J. HUNGERFORD, president of the Canadian National since 1932 and chairman of the board since 1936, has resigned the presidency of the system, including all subsidiary and affiliate companies. Mr. Hungerford was born near Bedford, Que.,

S. J. Hungerford

on July 16, 1872. At the age of 14 he began his career as a machinist apprentice in the shop of the South Eastern (now part of the C. P. R.) at Farnham, Que., in 1886. In 1891 he became journeyman machinist for the C. P. R. and worked at many points in Quebec, Ontario and Vermont. In 1894 he became chargeman at the Windsor Street station, Montreal. Beginning in 1897 a series of promotions through the mechanical department took him to jobs in many sections of the Dominion as follows: assistant foreman, Farnham, Que., 1897 to 1900; locomotive foreman, Megantic, Que., 1900 to 1901; general foreman, McAdam Junction, N. B., 1901; locomotive foreman, Cranbrook, B. C., 1901 to 1903; master mechanic, Western division, Calgary, Alta., 1903 to 1904. In 1904 Mr. Hungerford was appointed superintendent locomotive shops at Winnipeg, Man., and in 1908 became superintendent of the entire shop property at Winnipeg. In 1910 he started service with a constituent road of the present C. N. R., as superintendent of rolling stock of the Canadian Northern at Winnipeg. In 1915 he was transferred to the position of superintendent of rolling stock at Toronto, Ont. In 1917 he was promoted to general manager, Eastern lines, and upon grouping of the Canadian Northern, National Transcontinental and Canadian Government railways into the Canadian National in 1918 was appointed assistant vice-president (operating, maintenance and construction) of the new system. Two years later, in 1920, the Grand Trunk Pacific was brought into the amalgamation and Mr. Hungerford became vice-president in charge of these departments. In 1922 he became general manager of the system and in 1923 when the Canadian National had been made complete by the inclusion of the Grand Trunk he was appointed vice-president in charge of operation and construction. In 1932 Sir Henry Thornton resigned and Mr. Hungerford was appointed acting president. In 1934 this appointment was made permanent and in 1936 he assumed the additional duties of chairman of the board of directors.

Master Mechanics and Road Foremen

F. E. MOLLOY has been appointed master mechanic of the Southern Pacific, with headquarters at Bakersfield, Calif.

G. C. BOGART has been appointed assistant master mechanic of the Southern Pacific, with headquarters at West Oakland, Calif.

R. E. HARRISON has been appointed assistant master mechanic of the Southern Pacific, with headquarters at West Oakland, Calif.

E. WOODRUFF, shop superintendent of the Pere Marquette at St. Thomas, Ont., has been appointed master mechanic with the same headquarters.

D. BEATH, division master mechanic on the Canadian Pacific at Kenora, Ont., has been transferred to Winnipeg, Man.

J. B. HALLIDAY, master mechanic of the Pere Marquette at St. Thomas, Ont., has been transferred to the position of master mechanic at Grand Rapids, Mich., to succeed W. G. Griffith, deceased.

GREGOR GRANT, locomotive foreman on the Canadian Pacific at Fort William, Ont., has been appointed division master mechanic with headquarters at Kenora, Ont.

F. C. JOHNSON, general locomotive foreman on the Canadian Pacific, has been appointed division master mechanic at Calgary, Alta.

J. D. KILLIAN, assistant master mechanic of the Union Pacific at Portland, Ore., has been appointed master mechanic of the Oregon and Washington divisions, with headquarters at Albina, Ore.

Car Department

F. G. MOODY, master car builder of the Northern Pacific at St. Paul, Minn., has been appointed superintendent of the car department, with headquarters at St. Paul.

Shop and Enginehouse

ALBERT F. STIGLMEIER, general boiler department foreman of the New York Central at West Albany, N. Y., has been appointed general supervisor boilers and welding, with headquarters at New York. Mr. Stiglmeier was born in Buffalo, N. Y., on December 12, 1886. He received his education through the parochial school and the International Correspondence School. He became a boiler-maker apprentice on the Delaware, Lackawanna & Western at Buffalo, N. Y., in November, 1901. From 1905 to 1908 he was a journeyman boiler maker employed by the Tashenberger Bros. Co., the Howard Bros. Boiler Works, the Oldham Boiler Works, and the Barber Asphalt Paving Company, all of Buffalo; the New York Central at Depew, N. Y., and the D. L. & W. at Buffalo. In 1908 he became layerout and flanger on the D. L. & W. at Buffalo; in March, 1912, assistant boiler foreman on the Erie at Hornell, N. Y.; in July, 1912, general boiler department foreman on the Erie at Hornell; in November, 1912, assistant boiler department foreman in the locomotive shops of the New York Central at West Albany, and in 1917, general boiler department foreman at West Albany. From 1919 until 1923 he was employed as general boiler department foreman of the Baltimore & Ohio at the Mt. Clare (Md.) locomotive shops. He returned to the New York Central as general boiler department foreman at West Albany in November, 1923. Mr. Stiglmeier was chairman of

A. F. Stiglmeier

the executive board of the Master Boiler Makers' Association in 1926 and secretary in 1931. He has been secretary-treasurer of the association since 1936. He was president of the West Albany Locomotive Department Supervisors' Club in 1939 and is a member of the American Welding Society, of the Northern New York Section of which he was a member of the Executive Committee in 1939.

Obituary

L. A. NORTH, a retired master mechanic of the Illinois Central died on July 30.

THOMAS J. WHEATLEY, general foreman of the Chesapeake & Ohio at St. Albans, W. Va., died on June 28.

WILLIAM G. GRIFFITH, master mechanic of the Pere Marquette at Grand Rapids, Mich., died suddenly at his home in that city on June 24.